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# THESIS

PRIORITIZATION OF ADVANCED BASE  
FUNCTIONAL COMPONENTS

by

Linda A. Guadalupe

September 1988

Thesis Advisor: Samuel H. Parry

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19 ABSTRACT (Continue on reverse if necessary and identify by block number) This thesis explores the use of two analytical methods for obtaining a priority ranking of selected Advanced Base Functional Components (ABFCs) with regard to relative importance to mission accomplishment during the early days of a general wartime scenario. Specifically, eleven of the ABFCs most frequently mentioned by the Fleet Commanders-in-Chief as being their most urgent requirements were rated in two survey formats, one using categorical judgments and the other using a method of paired comparisons. In examining the results of using these methods, this study: 1) provides the differences in scope and application of the two techniques, and 3) provides a foundation for further study to obtain meaningful quantitative measurements of the need for selected ABFCs, measurements which can be used as aids to decision making in the budgetary process.					
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Prioritization of Advanced Base Functional Components

by

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Submitted in partial fulfillment of the  
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH


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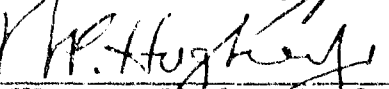
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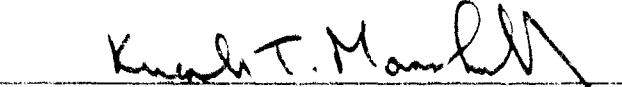
  
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## ABSTRACT

This thesis explores the use of two analytical methods for obtaining a priority ranking of selected Advanced Base Functional Components (ABFCs) with regard to relative importance to mission accomplishment during the early days of a general wartime scenario. Specifically, eleven of the ABFCs most frequently mentioned by the Fleet Commanders-in-Chief as being their most urgent requirements were rated in two survey formats, one using categorical judgments and the other using a method of paired comparisons. In examining the results of using these methods, this study: 1) provides one-time relative rankings of the ABFCs that were compared, 2) describes the differences in scope and application of the two techniques, and 3) provides a foundation for further study to obtain meaningful quantitative measurements of the need for selected ABFCs, measurements which can be used as aids to decision making in the budgetary process.



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## I. INTRODUCTION

Preparation for war is considered a most effective deterrent to war. In accordance with this philosophy, the United States has always sought to improve its ability to wage war by developing the tactics and procuring the weapons and material that will be most successful if it becomes necessary to wage, and win, a future war. Advanced bases are an important part of the preparation for war, and essential elements in the establishment of an advanced base are known as Advanced Base Functional Components (ABFCs).

The Table of Advanced Base Functional Components, OPNAV Publication 41P3b [Ref. 1] defines an ABFC as

a grouping of personnel, facilities, equipment, and material designed to perform a specific function or accomplish a mission of an advance base. [Ref. 1: p.1]

There are currently over 200 identified ABFCs, arranged in categories by type, including such types as administrative, medical, and communication-related ABFCs.

OPNAV Publication 41P3B is a catalogue of all formally designated ABFCs, and describes each one in terms of its intended mission, personnel required, cost data for preliminary planning, and material handling data for use in transportation planning. These data are used for the planning and procurement of ABFCs so that operations plans (OPLANS) and concept plans (CONPLANS) can be immediately and successfully executed in individual theaters in the event of a contingency. Thus, ABFCs comprise a substantial budgetary requirement in the business of preparing for war and other actions in defense of the United States and its allies.



The current procedure in the Department of the Navy is to plan ABFCs as War Reserve Material for future contingencies, rather than attempt to assemble them at time of ramp-up. This reduces the risk of having insufficient time to obtain the various materials that comprise ABFCs needed by the Fleet Commanders-in-Chief (FLTCINCs) in the most crucial early stage of the conflict.

## II. NATURE OF THE PROBLEM

As is the case with most logistics items in the planning system, ABFCs are not in a high priority category for budgeting purposes. The resources that will be needed in the near term, e.g., permanent-change-of-station (PCS) funds, servicemember pay and allowances, and weapons designed to meet a projected threat, always take precedence in the competition for limited defense funds. In the currently austere climate of government spending, it is especially difficult to obtain funds for non-urgent logistic support materials such as ABFCs. The problem then, for defense planners and ABFC sponsors, is to convince those who apportion the budget of the importance of ABFCs to the successful accomplishment of the FLTCINCs' and the Navy's mission: to be prepared for, and thus, to deter war.

Much of the difficulty in obtaining funds for ABFCs has been attributed to the fact that the need has been qualitatively, rather than quantitatively identified. It is easier to justify defense spending on an item or program when a numerical operational value is associated with it. If the need for ABFCs could be quantified in objective terms, with the nebulous property referred to as "contribution to mission accomplishment" actually measured, ABFCs would be in a better position to obtain available funding.

The existence of different OPLANS for various conflict scenarios has contributed to the difficulty in determining such measurements. Some of the questions that arise are:

1. Which OPLAN should be budgeted?
2. Which FLTCINC's requirements are the most urgent?
3. How should all FLTCINC's requirements be combined to arrive at the proper mix of ABFCs for inclusion in the budget request?

The diversity of form and function among different ABFCs, along with the variety of conditions under which they would be employed, suggested the need for an analytical approach which could compare items that have complex and unrelated functions, but contribute to the same overall objective. The way to accomplish such a quantification is by an analysis of the marginal increase in effectiveness for each ABFC, of which this study is the first step. This research does not provide values of marginal increase in effectiveness, which is the ultimate goal, nor does it address minimum quantities of ABFCs needed for a successful mission. However, it does provide the basis from which further study can produce those values by exploring the rank ordering of individual ABFCs using scientific methods so as to identify the ABFCs most crucial to the execution of a specific operation plan.

Some methods that the author considered for solving this problem involved non-linear regression techniques, successive intervals, pairwise comparisons, and fractional factorial experiments. The particular model chosen for this study was based on the type and scope of the data that could be collected in a reasonable amount of time.

### **III. PROCEDURE**

#### **A. SELECTION OF THE MODELS**

When ABFCs were previously used in World War II and the Vietnam conflict, the crucial activities of warfighting precluded exhaustive recording of data regarding the uses and relative benefits of ABFCs. Additionally, in peacetime, the emphasis on wartime ABFC requirements and objectives was naturally reduced. It was only recently (the early 1980's) that renewed interest was generated with regard to logistical support planning and ABFCs. [Ref. 2]

The only data previously available for use in prioritizing ABFCs was in the form of ordinal lists. These were the lists of the top thirty ABFC requirements of each Navy Service Component Commander submitted annually in June, in response to a directive of the Chief of Naval Operations. [Ref. 2] When OP-04, the assessment sponsor for ABFCs, wanted to identify the top five most critical ABFCs for the Strategic Logistics Appraisal to the Program Objectives Memorandum (POM) for 1990, the most recent of those FLTCINCs' lists were used. Taking the top thirty ABFCs listed by each FLTCINC for the current year, the overall prioritization for POM 1990 was determined by combining the professional judgments of the FLTCINCs, the ABFC resource sponsors, and the staff officers responsible for ABFC planning. For this study, the author used the eleven ABFC types most frequently mentioned by FLTCINCs in their June 1987 reports.

To solve the problem of prioritizing the need for ABFCs, it was decided that the data to be analyzed would best be obtained from the responses of

subject matter experts to a survey. Two models for obtaining relative rankings, using categorical judgments and pairwise comparisons, lent themselves readily to a questionnaire format, and were therefore chosen for this study. The analytical methods of constructing interval scales from categorical judgments [Ref. 3] and two pairwise comparison methods, the Constant Sum Method [Ref. 4] and the Analytical Hierarchy Process [Ref. 5], were chosen for manipulation of the data because of their direct applicability to the models and their ease of use.

#### **B. CONSTRUCTING INTERVAL SCALES FROM CATEGORICAL JUDGMENTS**

This method employs the results of a survey which requests judges to select the category that they think best describes the item under consideration. The categories represent successive intervals on a scale of measurement of the property being studied. These categories are assumed to be mutually exclusive and collectively exhaustive on a continuum describing the property. Section F.1. and Appendix D list the categories used in this study.

This technique assumes normality of responses over the intervals and is frequently used to elicit descriptive responses from judges to obtain numerical values for a property which is difficult to directly quantify. It is discussed in a paper by Professor Glenn Lindsay [Ref. 3], and was used in a recent Naval Postgraduate School thesis to measure the relative contribution of certain factors to combat power, a study similar in purpose but different in scope and background to this one. [Ref. 6]

The mathematical procedure used to establish an interval scale from categorical judgments is thoroughly and clearly described, with examples, in

both the referenced thesis [Ref. 6: pp. 10-19] and Professor Lindsay's paper [Ref. 3]. The following is a brief outline of the steps involved in this procedure.

1. The raw frequencies are arranged in an array where the rows are items rated and the columns are, from left to right, the least to the most favorable categories.
2. The relative cumulative frequencies are computed for each row, and are placed in a new array. All values less than 0.02 and greater than 0.98 are discarded. With  $k$  the number of columns removed, and  $n$  the number of rows, in the number of columns, the array is an  $n \times (m-k)$  matrix.
3. Using the assumption that the frequencies of step 2 are from a normal distribution, the values of  $Z$  that correspond to them are obtained from a standard normal distribution table. These are placed in a new array.
4. The row average,  $\bar{z}_i$ , is computed for each row (item) in the array obtained from step 3.
5. The column average,  $\bar{b}_j$ , is computed for each column in the same array. These values are the upper bounds on the categories represented by each column for the scale being developed.
6. The grand average of all values in the array,  $\bar{b}$ , is computed.
7. The sum of squares of the differences between the grand average,  $\bar{b}$ , and the column averages,  $\bar{b}_j$ , is computed. This result may be referred to as  $B$ .
8. The sum of squares of the differences between the normalized row averages  $\bar{z}_i$  (from step 4) and the individual normalized array values  $z_{ij}$  (from step 3) is computed for each row. The results may be referred to as  $A_i$ .
9. The square root of the ratio of  $B$  to  $A_i$  is computed for each row. The resulting values are estimates of the standard deviation from the mean of the responses for each item (row).
10. The scale values,  $S_i$ , for each item (row) are obtained by subtracting the product of each normalized row average,  $\bar{z}_i$ , and the standard deviation estimate  $\sqrt{B/A_i}$ , from the grand average,  $\bar{b}$ . [Ref. 6: pp. 12-13]

The reasoning which underlies the procedure described above is as follows. Each judge has an opinion about the scale value of an item  $i$ , and this opinion is assumed to be a normally distributed random variable with

mean  $S_i'$  and variance  $\sigma_i^2$ . Further, a judge views the continuum of these scale values to be divisible into successive intervals (categories), and he/she also has an opinion about the location of the upper bound of each category. The judge's "feelings" about the upper bound of category  $j$  is also assumed to be a normal random variable with mean  $b_j'$  and variance  $v_j^2$ , which is the same for all category bounds, so that  $v_j^2 = c$ .

It follows that a judge's feelings about the distance between a category's upper bound and the scale value of an item will also be a normally distributed random variable with mean  $b_j' - S_i'$  and variance  $\sigma_i^2 + c - 2\rho_{ij}\sigma_{ij}$ . It is assumed that the correlation coefficient,  $\rho$ , for all pairs  $i$  and  $j$  is zero, and therefore the variance is  $\sigma_i^2 + c$ .

The probability that an item  $i$  is rated below a category bound  $j$  is equal to the probability that a judge's "feeling" about the distance between category  $j$ 's upper bound and item  $i$ 's value is that it is greater than zero. This probability can easily be converted to a probability in the standard normal distribution by subtracting the judge's mean ( $b_j' - S_i'$ ) from the standard normal mean (0) and dividing by the judge's standard deviation ( $\sqrt{\sigma_i^2 + c}$ ). The proportion of judges who rated item  $i$  below the upper bound of category  $j$  is an estimate of this standard normal probability. (The conversion of the sample proportion values to standard normal values is described in steps 2 and 3 above.) With these standard normal values, multiple equations are available which can be solved to obtain the scale values  $S_i'$ .

The aforementioned equations are complex to solve initially because estimates of  $b_j$  and  $S_i$  are needed, as well as variance estimates. However, this can be remedied because the item scale values and the category bounds will be eventually located on the same interval scale, providing two degrees of

freedom that can be used to advantage. The origin of the interval scale can be set to zero, and the unit for the scale can be chosen such that the mean of the inverse standard deviations for the judges equals  $n$ , the number of items ranked. After these factors are incorporated into the computations,  $b_j$  and the variance estimates can be obtained. It is now possible to solve for the scale values,  $S_i$ . Steps 4 through 10 above perform the substitutions and further computations which eventually solve the basic estimating equation.

$$Z_{ij} = (b_j - S_i) / \sqrt{\sigma_j^2 + c} \quad S_i \quad \text{[Ref. 3: pp. 6-13]}$$

### C. THE CONSTANT SUM METHOD

The Constant Sum Method employs data from pairwise comparisons in order to determine the relative ranking of items of interest, with regard to their possession of a common property or contribution to a particular function. Respondees (hereafter referred to as judges) are asked to consider  $n$  elements in pairs with regard to a certain common property. All possible pairs are presented for consideration, for a total of  $(n(n-1))/2$  pairs. Therefore, the Constant Sum Method is best applied to a relatively small number of elements, generally less than 15. More comparisons than this would result in a survey too lengthy for judges to complete. In accordance with this limitation, it was decided to compare only the eleven ABFC types most frequently mentioned in the FLTCINCs' lists of top 30 requirements submitted in June 1987. A list of the ABFCs chosen and their descriptions from the Table of ABFCs [Ref. 1] are at Appendix A.

To use the Constant Sum Method as it is described in Professor Lindsay's paper [Ref. 4], the judges are asked to split 100 points between each pair, awarding the greater amount to that element which, in their estimation, possesses the greater amount of the property described. For purposes of this



study, it was decided that a point range smaller than the 100 point range would be more appropriate for comparing ABFCs, because of the diversity of their functions and to make it easier for the judges to award points. Therefore, the range of possible point values used was changed from 0 to 100 to 1 to 9, the same range of values employed in the Analytical Hierarchy Process [Ref. 5], which is also used in the State of the Art Contingency Analysis (SOTACA) model created for planners in the Office of the Joint Chiefs of Staff. [Ref. 7: pp. 4-27] This range was considered the best, based on previous study and Saaty's assessment:

Experience has confirmed that a scale of nine units is reasonable and reflects the degree to which we can discriminate the intensity of relationships between elements. [Ref. 8: p. 77]

The following is a list of the point values (hereafter referred to as intensity values) and their descriptions, as modified for the ABFC survey:

INTENSITY VALUE	DEFINITION	EXPLANATION
1	Equal importance	Loss of these two ABFCs would cause <u>equal</u> detriment to the mission. Both are needed equally.
3	Weak importance of one over the other	Your experience and judgment tell you that one ABFC is <u>moderately needed</u> more than the other.
5	Essential or strong importance	Experience and judgment tell you that one ABFC is <u>strongly needed</u> more than the other.
7	Very strong importance	One ABFC is <u>very strongly needed</u> more than the other; its dominance is obvious from experience.

9	A b s o l u t e importance	Your unqualified opinion is that there is the <u>highest</u> <u>order of need</u> for one ABFC over the other.
2, 4, 6, 8	I n t e r m e d i a t e values between two adjacent intensities	W h e n   y o u   m u s t compromise. [Ref. 5: p. 54]

These intensity values were converted to a 100 point scale for employment in the Constant Sum Method by performing a ratio transformation, as follows:

# of points awarded to preferred component = (intensity value x 100) ÷ (intensity value + 1)

# of points awarded to other component in pair = 100 - the above result

This transformation results in a 100 point split which is equivalent to the intensity value. Therefore, an intensity value of 1, which indicated equal importance, was translated into a 50 - 50 split between the pair.

Each judge's responses on the 100 point scale are then assigned to an  $n \times n$  matrix, with  $a_{ij}$  being the number of points awarded to component  $j$  when compared to component  $i$ , and  $a_{ji}$  being the number of points awarded to component  $i$  in that same comparison. There is one matrix for each judge, and cross-diagonal elements in each matrix sum to 100, with all diagonal positions containing the value 50.

Taking an average of all elements over a total of  $m$  judges, one composite matrix is formed, called AB, where

$$\bar{a}_{ij} = \frac{\sum_{k=1}^m a_{ijk}}{m} \quad (k \text{ denotes judge}). \quad (1)$$

This aggregation of the judges' responses is used for all remaining calculations, so that the number of judges is hereafter suppressed. This implies that this method can be used with the responses of any number of judges, although a large number (>20) would provide a less biased result for use as a group decision aid.

A new  $n \times n$  matrix, called  $W$ , is computed from the  $AB$  matrix as follows:

$$W_{ij} = \frac{\bar{a}_{ij}}{\bar{a}_{ji}} \quad (2)$$

where cross-diagonal elements in the  $W$  matrix are reciprocals of each other. The ratio of  $\bar{a}_{ij}$  to  $\bar{a}_{ji}$  is an estimate of the ratio of the scale value of item  $j$  to the scale value of item  $i$ . Therefore, from equation (2):

$$W_{ij} = \text{estimate of } S_j / S_i \quad (3)$$

where  $S_i$  is the scale value for component  $i$ . Assuming that this estimate is a perfect estimate for  $S_j / S_i$ , we can take natural logarithms of the equality. The result is

$$\ln W_{ij} - (\ln S_j - \ln S_i) = 0 \quad (4)$$

If  $n$ , the number of components analyzed, is greater than three, there will be more estimating equations than there are scale values to estimate. The method of least squares is employed to resolve this problem. The difference between the  $W$  value (the estimate of the ratio of the scale values) and the true ratio of the scale values is minimized using the derivative of the natural logarithm form of equation (4). The steps below show how the least squares method is used.

Scale values are sought which satisfy the following:

minimize  $X$ , where

$$X = \sum_{i=1}^n \sum_{j=1}^n (\ln W_{ij} - (\ln S_i - \ln S_j))^2 \quad (5)$$

Taking the derivative of equation (5) with respect to  $S_j$ , setting  $\delta X / \delta S_j = 0$ , and solving for  $\ln S_j$  results in

$$\ln S_j = \frac{\sum_{i=1}^n \ln W_{ij}}{n} + \frac{\sum_{i=1}^n \ln S_i}{n} \quad j=1,2,\dots,n. \quad (6)$$

Any unit of measure can be chosen for the scale, which is unitless. Therefore, to simplify the computations, set the mean scale value to zero:

$$\frac{\sum_{i=1}^n \ln S_i}{n} = 0. \quad (7)$$

Substituting the result of equation (7) into equation (6), the least squares estimates of the scale values become

$$\ln S_j = \frac{\sum_{i=1}^n \ln W_{ij}}{n} \quad j=1,2,\dots,n. \quad (8)$$

Solving for individual  $S_j$ 's shows that each scale value is equal to the geometric mean of the values of the corresponding column in the  $W$  matrix, or

$$S_j = \left[ \frac{\sum_{i=1}^n W_{ij}}{n} \right]^{1/n} \quad j=1,2,\dots,n. \quad (9)$$

[Ref. 4: pp. 3-4]

#### D. THE ANALYTICAL HIERARCHY PROCESS

The Analytical Hierarchy Process of computing scale values from pairwise comparisons employs the same 1 to 9 scale of preference intensity values described in Section III. C. above. However, the mathematical method varies somewhat. If a judge awards an intensity value of 5 to item  $X$  when

preferring it to item Y, then it is assumed that the converse comparison, the value of preference of item Y "over" item X is the reciprocal, or 1/5. Therefore, the missing values in the raw data matrix, i.e., the positions that are cross-diagonal to the whole number comparisons that the judges provided, would be the reciprocals of those whole number values. [Ref. 5: p. 78]

Using the whole number values provided by judges as the raw data, the steps in the method are outlined below.

1. Construct the completed matrix for each judge by inserting the appropriate reciprocal values in the blank cross-diagonal positions, and enter the unit comparison (1) down the main diagonal. These matrices will be referred to as the A-prime matrices, with the entries  $a'_{ij}$ .
2. To aggregate the responses of all judges, take the geometric mean of the corresponding  $a'_{ij}$  values. The result is a single matrix, which can be called the AB-prime matrix.
3. Normalize the resulting matrix by dividing the column elements,  $a'_{ij}$ , by the respective column sums,  $\sum_{i=1}^n a'_{ij}$ .
4. The scale values,  $S_j$ , are computed by averaging over the normalized columns obtained from step 3 above. [Ref. 5: pp. 19-20]

#### **E. SELECTION OF JUDGES**

Because of the need for subject matter experts in ABFC and/or logistical planning, judges for this study were individually selected. They were obtained by accessing three sources. Persons who attended the Workshop in Operational Logistics at the Naval Postgraduate School, Monterey, California, in February, 1987 were considered to be candidates, and those who were assigned to staff positions involving logistics planning outside the Naval Postgraduate School were selected to serve as judges. The planning sponsor for ABFCs in OP-41, CDR Bob Miller, and other members of the OP-04 staff provided the names of staff members in various commands with whom they

worked on matters involving ABFC definition and planning, and they were added to the list of judges. Finally, judges were asked in the survey itself to make copies of the survey and forward them to other individuals who were familiar with some or all of the ABFCs.

#### **F. THE SURVEYS**

A total of 24 judges were selected to participate, and a package containing both surveys (the one requesting categorical judgments and the one requesting pairwise comparisons) was forwarded by mail to each one. A sample survey package is at Appendix B. The scenario described for use by the judges in framing their responses to both surveys was associated with the most general of the OPLANS, and is known as the "base case" scenario. In general, this scenario is the outbreak of global conventional war, with the fighting starting in Europe. It was deemed appropriate to use the "base case" scenario because it is familiar to fleet planners, is the most mature of the OPLANS, and as the description suggests, is considered widely applicable. In addition, the "base case" scenario was adopted because of the accessibility of the background information (individual OPLANS are classified) and because of the ability to locate, in a short time, a sufficient number of subject matter experts familiar with the general plan. This generalization of the situation was also the most appropriate to use because of the initial goal: to prioritize ABFC types by contribution to mission accomplishment, without determining which is the most crucial theater or which OPLAN is most likely to be executed in the next contingency. Finally, staff members in the ABFC planning arena who were queried recommended the "base case" scenario as the best one to be used for the purposes of the survey.

## **1. Survey 1: Categorical Judgments**

By stating that the judge had all the ABFC assets he/she needed, and by requesting a rating of detriment to the mission if a given ABFC capability was lost, it was possible to elicit the importance of each in its own right, unaffected by the others. There were four categories to describe the detriment felt if the capability of the given ABFC was lost: no detriment, some detriment, serious detriment, and warstopping. These were chosen because they seemed to be mutually exclusive and collectively exhaustive in describing possible levels of detriment.

## **2. Survey 2: Pairwise Comparisons**

For the pairwise comparison survey it was decided that the best way to elicit a judge's estimate of the importance of a given ABFC to warfighting capability, relative to other ABFCs, would be to phrase the survey as follows: If all ABFCs were initially available, and both of those in the given pair became unavailable, which loss would cause the most detriment to warfighting operations? In addition, how much more intense would be the loss of it than the loss of the other?

It was determined that the positions of the pairs on the survey should be random, so as to preclude a response from being dependent on another response involving a nearby pair with a common component. To randomize the positions, each pair was assigned a number from 1 to 55, and the number 55 was operated on using the monadic function "roll" in APL (A Programming Language). The command "roll n" causes the program to select each of the integers from 1 to 55 in random order, until all possible integers in that range have been chosen. The vector produced by the command "roll 55" was the order in which the pairs were placed in the survey.

## **G. ANALYSIS**

### **1. Transformation of Survey 1 to Scale Values**

A total of 23 completed surveys were received for analysis, and the responses were manually tallied and entered into an array in APL (A Programming Language). Eleven ABFCs were rated, and with the four categories, the input was an 11 x 4 matrix. Three APL programs created by Paul Crawford [Ref. 6, pp. 87-88] to perform the computations of this technique were reviewed, and it was determined that they were general enough to be applied to the data in this study. These programs included: Normalization of Cumulative Frequencies, Normal Table Look-Up (developed at NPS), and Determination of Cumulative Frequencies. The programs are included at Appendix C. The process of converting from the raw data of Survey 1 to scale values is recreated in Figure 1. The data obtained using this process are included at Appendix D.

### **2. Transformation of Survey 2 to Scale Values using Both the Constant Sum Method and the Analytical Hierarchy Process**

The 23 sets of responses to the paired comparison survey were entered into a computer data file that could be read by a FORTRAN computer program. A FORTRAN-77 program was created which performed all calculations necessary for converting the raw responses (intensity values) into scale values for each of the ABFCs using both analytical methods. This program is at Appendix C. Both methods of converting the raw data from survey 2 into scale values are shown in Figure 1. The data obtained using the two processes are included at Appendix D.



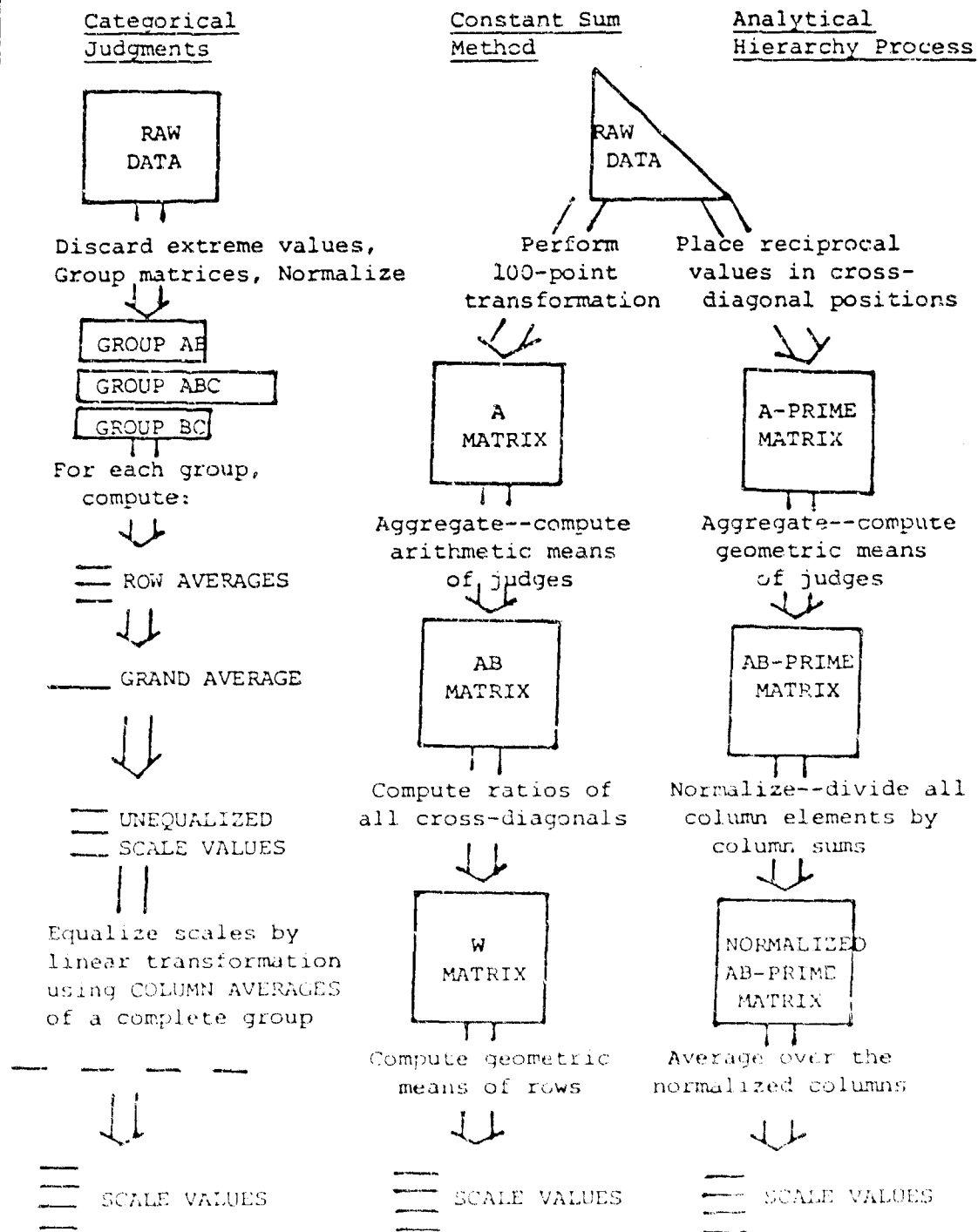


Figure 1. Conversion of Raw Data to Scale Values

#### IV. RESULTS

##### A. CONSTRUCTING INTERVAL SCALES FROM CATEGORICAL JUDGMENTS

The final scale positions obtained from this procedure for each ABFC studied are shown in Figure 2.

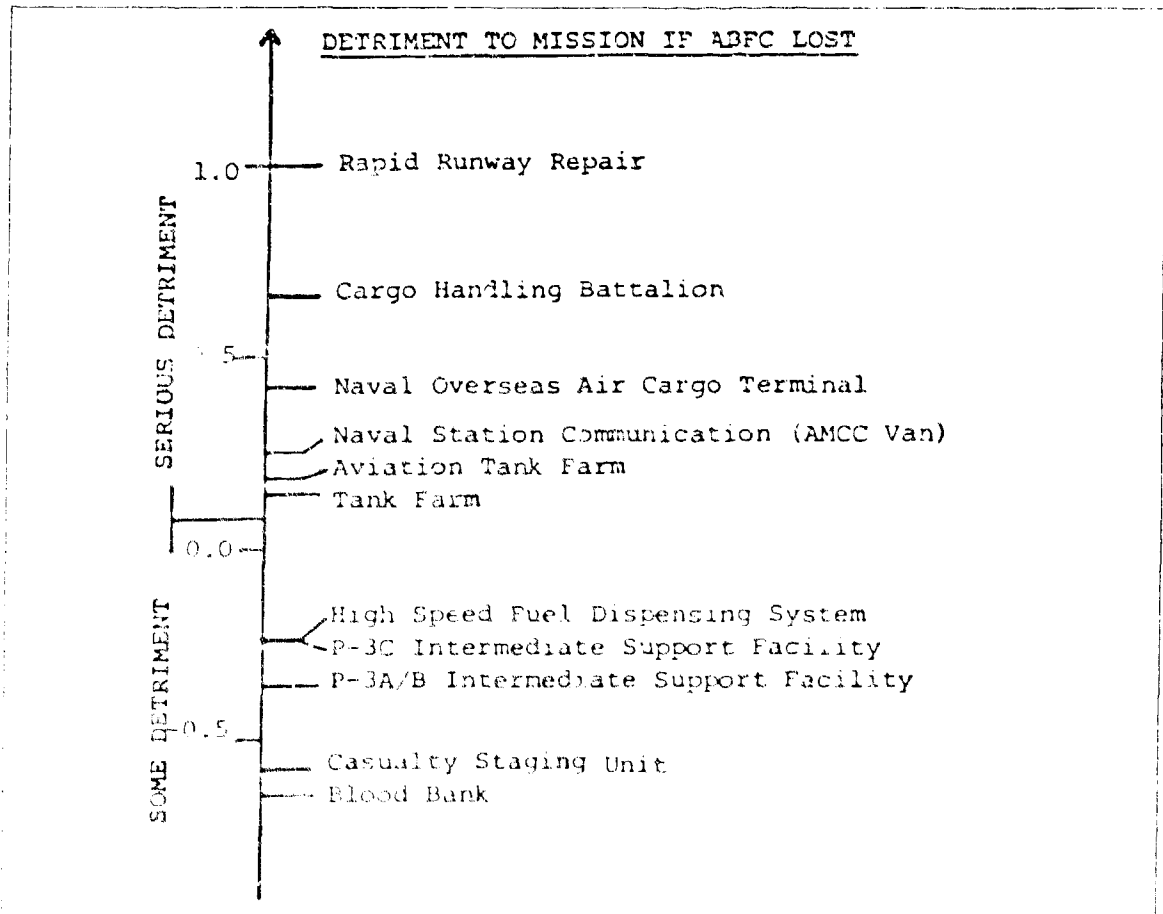


Figure 2. Scale Obtained using Categorical Judgments

##### B. THE CONSTANT SUM METHOD USING PAIRWISE COMPARISONS

The final scale positions of the ABFCs obtained from this procedure are shown in Figure 3.

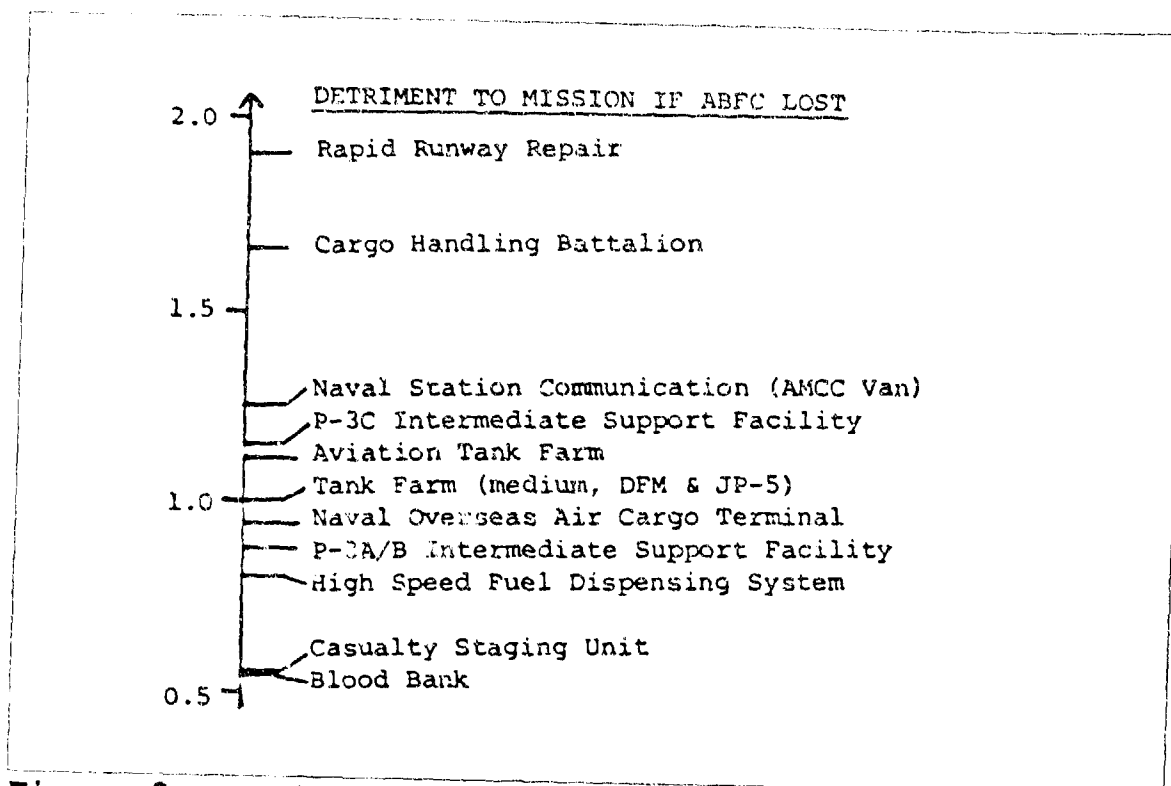


Figure 3. Scale Obtained using Constant Sum Method

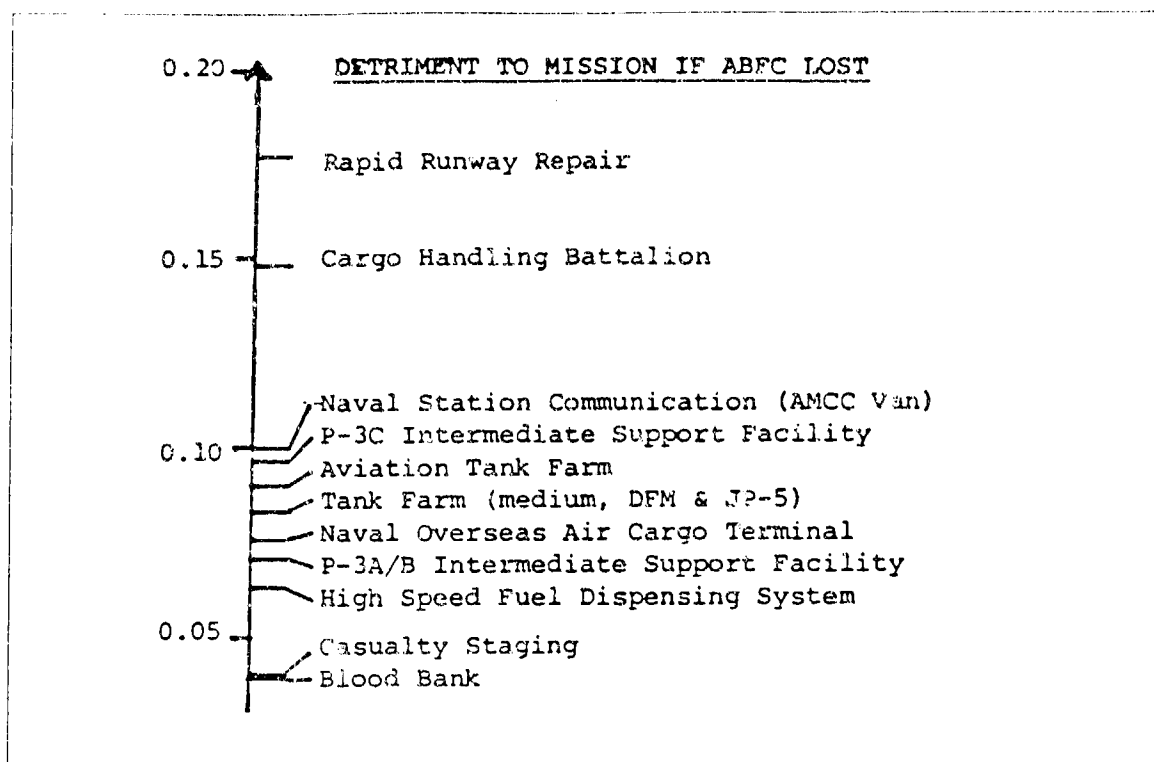
#### C. THE ANALYTICAL HIERARCHY PROCESS USING PAIRWISE COMPARISONS

The final scale positions of the ABFCs obtained from this procedure are shown in Figure 4.

#### D. DISCUSSION

The rankings obtained using the method of constructing interval scales from categorical judgments show the importance of individual ABFCs, without regard to the preference of one of them over any other. This is perhaps the purest scale for measuring the contribution to mission accomplishment of any given ABFC.

With regard to the two mathematical techniques used on the data obtained from pairwise comparisons (the Constant Sum Method and the



**Figure 4.** Scale Obtained using Analytical Hierarchy Process

Analytical Hierarchy Process), the numerical scale values obtained for the ABFCs are different, but the rank orderings of the ABFCs are identical (see Figures 3 and 4). This feature was expected, in view of the fact that the two methods are equivalent in rationale and use the same raw data. The final rankings seemed to match the intuitive predictions made by the author after review of the raw responses from the completed surveys before they were entered into the program. For example, it was noticed that the medical type ABFCs were frequently disfavored when compared to any of the other types, and they are the last two in the rank ordering. Also, many judges consistently favored the Rapid Runway Repair Kit and the Cargo Handling Battalion over other types, and they were computed to be the top two in the list.

The aforementioned rankings obtained from the pairwise comparison data are different from those obtained from the categorical judgments (using the interval scale technique) (Figures 2 and 3). These differences can be attributed to the introduction of dominance in the process of making pairwise comparisons. For example, the need for a Blood Bank in its own right is validated strongly by the responses to Survey 1, but when it is always being compared to another, usually an "attack-oriented" ABFC, where one of the pair can be chosen to be more important, it is consistently dominated. This helps to explain its position at the bottom of the relative ranking in the Constant Sum Method and Analytical Hierarchy Process.

Despite an overall difference in the rankings, the number one and number two ABFCs resulting from the pairwise comparisons and the categorical judgments were the same: Rapid Runway Repair and Cargo Handling Battalion, respectively. This validates the strength of the judges' views on their importance to the mission, both in their own right and when compared to other ABFCs. Similarly, Casualty Staging Unit and Blood Bank remained the last two in the rankings obtained from both methods. This high correlation between the results of two very different methods of ranking emphasizes that warfighting mission ABFC types (e.g., Rapid Runway Repair, etc.) are of much greater importance to the judges than life support types (e.g., Casualty Staging Unit, Blood Bank). This could be the result of a strictly operational and combat orientation of most of the judges polled as well as the fact that the scenario was stated to be the very early days of the conflict when casualties can be assumed to be low. If the author had been able to poll more individuals with different personal orientations, the responses and results may have been different.

The differences in rankings produced by the categorical judgments as opposed to the pairwise comparisons occurred among the middle rankings (Figure 2 versus Figure 3 or Figure 4). Two computations were performed to measure the significance of those differences. The Rank Coefficient and Spearman's  $\rho$  are two measures of rank correlation which both have a possible range of -1 to 1. A value of -1 represents perfect disagreement between the rankings, while a value of 1 represents perfect agreement. For the two methods used in this study, the Rank Coefficient computed was 0.70709 and Spearman's  $\rho$  was 0.97121, indicating strong agreement between the methods.

## V. CONCLUSIONS AND RECOMMENDATIONS

Although individual measures of effectiveness for ABFCs were not obtained, the models used in this study provided relative measures of the contribution of each one to mission accomplishment. The model used in Survey 1, categorical judgments, made no assumptions about the relationship of one ABFC to another, but placed each one in its estimated position on a common scale. The method of paired comparisons used in Survey 2 provided the same kind of result, but required that judgments be made on a ratio scale, implicitly assuming a common origin for the ratio.

The three analytical procedures (construction of the interval scale, the Constant Sum Method, and the Analytical Hierarchy Process) are computationally simple and were easily performed using the data from the surveys. They are useful tools for converting judges' opinions to relative quantities. In particular, the Constant Sum Method and the Analytical Hierarchy Process are simple, yet effective models for obtaining scale values for diverse components when a ratio scale is desired or acceptable. However, the fact that all possible pairs must be considered makes them too cumbersome for surveys to be used if the number of components to be compared is larger than 15.

Based on the assumptions made for Survey 1 using categorical judgments (normality, homogeneity of variance), the interval scale values obtained give the following information: of the eleven ABFCs rated, Rapid Runway Repair is most needed for mission accomplishment, Cargo Handling Battalion is next most needed, etc. Only relative rankings are obtained, and no statements can

be made about proportionality of values, etc. However, one can make the statement that, if it is determined that the Blood Bank is essential to the mission, then the AMCC Van is more essential, and the Rapid Runway Repair is much more essential. No other statistical conclusions can be inferred.

In Survey 2, no underlying assumptions were made about normality, as in Survey 1. However, a common origin for the 1 to 9 scale of intensity values was assumed, and relative rankings were derived from the results obtained using the two techniques for pairwise comparisons (Constant Sum Method and Analytical Hierarchy Process). In addition, because the resulting values were on a ratio scale, one can say that Cargo Handling Battalion is needed approximately twice as much as High Speed Fuel Dispensing System. Distances between items on the scale can be commented on in terms of proportionality.

For purposes of choosing between two ABFCs with regard to need, it is intuitively felt that the Constant Sum Method would be more useful as an aid to decision-making involving preference. However, the method of constructing interval scales from categorical judgments is more trustworthy because the judges are given descriptive reference points to bound their ratings, and assumptions of normality and homogeneity of variance are appropriate. Therefore, the rank ordering of ABFCs obtained from the categorical judgments of Survey 1 is considered to better reflect the true hierarchy in terms of contribution to mission accomplishment. It is interesting to note that when solicited for comments regarding which survey was more appropriate for the purpose described, judges frequently mentioned that Survey 1 was better because it was easier to respond to. Appendix E contains a synopsis of those comments.



Further study is recommended to determine the minimum amounts of a given ABFC needed for the success of both the 'base case' and other particular OPLANS. Also, cost effectiveness could be examined. It was not considered in this study and the notion arose that, if judges had been specifically requested to consider the costs of the different ABFC packages (including purchase and transportation costs), the responses might have been different. Future research should include the cost consideration, while asking judges whether they preferred, for example, two Blood Banks or one Aviation Tank Farm.

A full factorial experiment should be performed, using categorical judgments, to determine the marginal increase in mission effectiveness for each crucial ABFC type. Also, a similar experiment which compares different ABFCs not only to each other but also to such items as weapons, spare/repair parts, fuel, etc. would be especially useful to support decisions involving trade-offs in the budget. The results would provide a valuable decision aid for planners and sponsors in making appropriate budgetary decisions, as well as justifying them, in the future.

## APPENDIX A. LIST OF ABFCs STUDIED AND DESCRIPTIONS

### LIST OF ABFCs

- 1 Naval Station Communication (AMCC Van)
- 2 Cargo Handling Battalion
- 3 P-3C Intermediate Support Facility
- 4 Tank Farm (medium, DFM & JP-5)
- 5 Rapid Runway Repair
- 6 High Speed Fuel Dispensing System
- 7 Casualty Staging Unit
- 8 P-3A/B Intermediate Support Facility
- 9 Flood Bank
- 10 Aviation Tank Farm (basic)
- 11 Naval Overseas Air Cargo Terminal (large)

The following pages contain descriptions from the Table of ABFCs [Ref. 1] for the ABFCs listed above, including mission, equipment, personnel, and supplies needed.

1. MISSION - A transportable communications component to provide local and long haul, external communications to support a small naval station or naval air facility including common user access to the Naval Communications System. Specialized subsystems for local air/ground, GCA, industrial, security, port services, etc. are not included. (The C3A component is selfsufficient. No other ABFC components are required for its operation. The C3A component is capable of supporting any ABFC components that require communications support.)

The Advanced Base Functional Component (ABFC) C3A van contains the following systems/circuits in one transportable equipment shelter with two portable generators:

- a. One secure voice circuit via satellite (FLTSEVOCOM).
- b. Two wideband secure voice circuits via UHF Line of Sight (LOS) (NESTOR).
- c. Two narrowband secure voice circuits via UHF LOS, UHF Satellite, HF, or landline (PARKHILL).
- d. Two full duplex secure teletype (TTY) circuits each capable of UHF LOS, UHF Satellite, HF, or landline operation.
- e. One UHF satellite AN/SSR-1 receive broadcast circuit (PLTSATCOM).
- f. Two HF plain voice circuits (HICOM).
- g. Two UHF LOS plain voice circuits.

The ABFC van is an insulated aluminum shelter mounted on a mobilizer which may be transported by air, ship, or towed by a prime mover. The van is designed to be transportable via (a single lift in C-130 or larger aircraft or the CH-53E helicopter (with lifting slings)). The van is capable of being towed at speeds up to 50 MPH on smooth terrain or speeds up to 25 MPH on rough terrain. Primary AC power for the van is normally provided by a 30 KW portable generator (two are provided). The van also has the capability to utilize power sources other than the generator, such as base or commercial power. (The ABFC (C3A) van system is 100 percent containerizable.)

The total ABFC van system consists of the following components:

- a. ABFC (C3A) Shelter, Gichner Model GMS-240-MF-(ISO)
- b. MEP-005 30 KW 50/60 Hz Generator (2 each) with the following modifications: fuel winterizing kit, electric winterizing kit, wheel mounting kit, and spark arrestor kit.
- c. M-1022 Mobilizers and Adapters
- d. Major/Ancillary/Electronics Equipment

- e. Test Equipment
- f. 35' Whip HF Transmit Antennas (two each)
- g. Helical Satellite Antenna
- h. TACO D-2214 Omnidirectional UHF Antenna
- i. 35' Whip HF Receive Antennas (two each).
- j. AS-2815/SSR-1 Satellite Receive Antenna
- k. Power Distribution/Monitor/Protection System Part of (P/O) Shelter
  - 1. Interconnecting Cables

2. PERSONNEL      0 OFFICERS      17 ENLISTED MEN      TOTAL 17

OFFICERS						ENLISTED MEN				
Ech	No	Rank	Desig	Billet	Rate	Gp	Pay Gr	PNEC	SNEC	Title
	1				RMC	5	7	2319		Technical Controller-Supervisor
	1				ET1	3	6	1438		ABFC (C3A) Maintenance Technician
	1				ET13	3	6	1453		SATCOM Technician
	1				EN2	7	5	4294		Refrigeration/AC Technician
	1				EM2	7	5	5632		Shore Based Power Technician
Enlisted Men (Augmentation Crew)										
	2				RM2	5	5	2318		Technical Controller-Operator
	1				RM3	5	4	2318		Technical Controller-Operator
	1				RM2	5	5	2316		TTY Repair
	1				ET2	3	5	1420		HF Transmitter Technician
	1				ET2	3	5	1445		KY 75 Technician
	1				ET2	3	5	1425		WSC-3 Technician
	1				ET2	3	5	AT6632		KY 28 Technician
	1				EM3	7	4	5632		Shore Based Power Technician
	1				EN3	7	4	4294		Refrigeration/AC Technician
	1				SK3	5	4			Supply Clerk (Independent Duty)
	1				HN1	10	6			Corpsman (Independent Duty)
Enlisted Men (Security Force-if required)										
	1				PO1	6				Leading Petty Officer (Security)
	6				SN/SA	1/2				Small Arms Trained (Security)

### 3. COST

NAVAIR  
SPAWAR The cost for SPAWAR managed items \$2,000,000  
NAVFAC \$123,228  
NAVSUP  
NSF  
NAVFAC  
Identified (Other) \$ 4,743

### 4. CONSTRUCTION

Cleared 600 foot diameter area  
Power: 1 KVA  
Construction Time: 200 Man Hours

### 5. MATERIAL (MAJOR ITEMS)

1 EA Communication shelter  
2 EA 30 KW generators, trailer mounted  
1 EA Truck, 2 1/2 ton, 6x6 not P/O Communications van  
2 EA Trucks, 3/4 ton, 4x4 not P/O Communications van

#### Supplies

Installation materiel and tools  
Administrative and general supplies  
Fuel and POL  
Spare parts Same as COSAL 005 885.

#### Facilities (Required but not included)

Personnel housing and support  
Telephone hook up service  
Storage for spares

WEIGHT: 43,300 lbs (21.7 Short Tons)

CUBE: 3500 CU. FT. (87.5 Measurement Tons)

# NAVAL SUPPLY SYSTEMS COMMAND

## Sub-Function Codes

Ref	WT	CU
11 Administrative equipment and supplies	1536	135
14 General equipment and supplies	436	44

# SPACE AND NAVAL WARFARE SYSTEMS COMMAND

## MAJOR EQUIPMENT

DESCRIPTION	U/I	QTY
TSEC/KY-58 Crypto	EA	2
*TSEC/KY-28 Crypto	EA	2
**Dual PARKHILL Crypto	EA	1
***TSEC/KG-36 Crypto	EA	2
**TSEC/KW-7 Crypto	EA	4
**TSEC/KWX-11 Crypto	EA	4
AN/WSC-3(V)2 UHF SATCOM and LOS Receiver	EA	4
UHF Diplexer SATCOM Diplexer	EA	1
Preamplifier SATCOM Preamplifier	EA	1
AN/URA-23 HF Transmitter	EA	2
AN/URA/38 HF Multicoupler	EA	2
AN/SSR-1 UHF Satellite Broadcast Receiver	EA	1
AM-4823 HF Preselector	EA	4
DA-607 Dummy Load (Part of P/O AM-4823)	EA	1
CG-1961/U Antenna Coupler (P/O AM-4823)	EA	1
R-1051P/URR HF Receiver	EA	4
AN/URA-17P TTY Converter	EA	2
CV-3333/U Vocoder	EA	1

# MAJOR EQUIPMENT (CONTINUED)

		U/I	QTY
CN-143(V)4/USQ	Interconnecting Group	EA	1
TT-603	TTY Transmitter Distributor	EA	2
TT-605	TTY Reperforator	EA	2
AN/UGC-77	TTY Keyboard Printer	EA	4
AN/URQ-23	Frequency Standard	EA	1
AM-2123	Frequency Distribution Amplifier	EA	1
TH-83	Hubbing Repeater	EA	1
C-8657	Autophaser	EA	1
PP-6521/FG	+ or - 6 VDC Power Supply	EA	2
SB-3684/FG	Ballast Lamp Panel	EA	2
SB-3503/FG	Fuse Panel	EA	2
SB-3092	Audio Patch Panel	EA	2
SB-3189	DC Patch Panel	EA	3
ME-400	+ or - 6 VDC Monitor Meter (P/O AM-4823)	EA	2
NONE	Dual Parkhill Speaker Assembly	EA	1
NONE	Dual Parkhill Cable Termination Assembly	EA	1
NONE	Dual Parkhill Line Termination Assembly	EA	1
NONE	AN/SSR-1 Low-Level Driver	EA	1
NONE	KY-58 Interface Adapter	EA	2
NAVAIR 19-45-2	28 VDC Power Rectifier	EA	1
Acopian Model	28 VDC Power Supply	EA	1
Andrews 63305-5	UHF Helical SATCOM Antenna	EA	1
CU-691/U	Antenna Coupler	EA	1
SA-2.82	RF Distribution	EA	2

# MAJOR EQUIPMENT (CONTINUED)

		U/I	QTY
AS-2815/SSR-1	UHF Satellite Broadcast Receive Antenna	EA	1
D-2214	UHF Omnidirectional Antenna	EA	1
NONE	35FT HF Whip Antenna	EA	4

\*NESTOR terminals (KY-8, KY-28, KY-38) are in the process of being replaced by VINSON COMSEC equipment (KY-57, KY-58). When phase-in is complete all NESTOR equipment will require one-for-one replacement by VINSON.

\*\*PARKHILLS will eventually be replaced by ANDVT in the post FY-87 time period. KG-84 equipment is replacing KW-7/KG-36 equipment in the FY-88 time period.

## ANCILLARY EQUIPMENT

DESCRIPTION		U/I	QTY
Security Storage Safe		EA	1
LPW-300	TIY Paper Winder	EA	4
Tork Model 430	Emergency Lights	EA	1
Aditech 5060A	Dual Speaker Amplifier	EA	4
GTE Model 500	Telephone	EA	1
WECO Model 270BW	Automatic Disconnect Switch	EA	1
WECO Model RIAW	Non-Inductive Ringer	EA	1
H-169/U	Handset	EA	2
ITT Model 00066-CB-13	Handset	EA	2
Locally Manufactured			
EN/SSR-1 Monitor/Patch Panel		EA	1
Trunk Monitor/Patch Panel		EA	1
UHF Secure/Plain Voice Control Panel		EA	1
28 VDC Control Panel		EA	1



# ANCILLARY EQUIPMENT (CONTINUED)

	U/I	QTY
AC Power Monitor Panel	EA	1
AC Power Phase Detection/Power Transient Suppression Assembly	EA	1
Plain Voice Amplifier Assembly	EA	1
UHF Secure Voice Red Junction Box	EA	1
UHF Secure Voice Black Junction Box	EA	1
Black Main Distribution Frame	EA	1
Red Main Distribution Frame	EA	1
Power Combiner Assembly	EA	1
RT-1107/WSG-3 Patch Panel	EA	1
TA-970 Voice Handset	EA	8
MK-250 Antenna Pressurizing Kit	EA	1
NONE HF Patch Panel	EA	1
NONE Equipment Racks	EA	15

## ANTENNA AND MISCELLANEOUS CABLES

Description	U/I	QTY
UHF Transmission Line Cable, RF, W435	EA	1
UHF Transmission Line Cable, RF, W435A	EA	1
AS-2815/SSR-1 Transmission Line Cable, RF, W437	EA	1
HR9N-P Transmission Line Cable, RF, W438	EA	1
HF Receive Whip Transmission Line Cable, RF, W401	EA	1
HF XMT Whip Transmission Line Cable, RF, W416	EA	1
HF XMT Whip Transmission Line Cable, RF, W417	EA	1
HF XMT Whip Coupler Control Cable W702	EA	1
HF XMT Whip Coupler Control Cable W703	EA	1

# ANTENNA AND MISCELLANEOUS CABLES (CONTINUED)

Generator Power Cable, AC, 4 Cond	EA	1
Generator Parallel Cable, AC, 4 Cond	EA	1
Signal Grd Cable Wire #2/0 AWG	EA	1
HF Antenna GRD Plane Wire #8AWG with 2 1/2 FT Grd Rod	EA	30
35 Ft Whip Antenna Nylon Rope Guys	EA	9
Van Lifting Sling P/O Van	EA	1

## TECHNICAL DOCUMENTATION

<u>NAME</u>	<u>SPAWAR NO.</u>
Satellite Communications Set	
AN/WSC-3 VOL-1	0967-LP-545-4050
VOL-2	0967-LP-545-4060
VOL-3	0967-LP-545-4070
Operating Instructions Satellite Set	0967-LP-545-4020
AN/WSC-3	
Receiving Set. Satellite Signal	0967-LP-541-9020
AN/SSR-1 & AN/SSR-1A	
Antenna Coupler Group	0967-LP-297-6010
AN/URA-38A	
Radio Receiver	0967-LP-617-7010
R-1051 F/URR	
Maintenance Standard Book	0967-LP-617-7020
Radio Receiver R-1051F/URR	
Audio Digital Converter	0967-LP-617-1010
CV-3333/U	
Low Level Tech Control Equipment	0967-LP-391-6010
Interconnecting Group	0967-LP-614-7010
On-143(V) USQ	
Telephone Set	0967-LP-625-2010
TA-970/U	

TECHNICAL DOCUMENTATION (CONTINUED)

<u>NAME</u>	<u>SPAWAR NO.</u>
Transmitter - Teletypewriter Control C-8657(P)/UG	0967-423-6010
	<u>NAVSHIPS NO.</u>
Radio Frequency Presselector - Amplifier AM-4823/U	0967-28-3010
Antenna Coupler CU-691/U	0969-LP-969-8010
Technical Document Drawings 27732-28000	
Model 28/32 RFI Wiring Diagram Package	-
Wiring Diagram Package for Receive Only Typing Reperforator	-
Teletype Bulletin 295B Motor Unit	-
Teletype Bulletin 1197B Model 28 Compact TTY Set	0967-059-9020
Teletype Bulletin 284B Model 28 Compact TTY Set	0967-059-9010
Teletype Bulletin 284B Model 28 Compact TTY Set	0967-059-9030
Bulletin 322B/RF 28 Reperforator & Tape Printer	0967-173-9030
Bulletin 322B 28 Reperforator & Tape Printer	0967-173-9020
Bulletin 322B 28 Reperforator & Tape Printer	0967-173-9010
Frequency - Time Standard AN/URQ-23	ET710-AA-OP-1-C10/5102
	<u>NEEACTPHIL NO.</u>
AMCC Van Installation Drawings	26990-40301

# TECHNICAL DOCUMENTATION (CONTINUED)

<u>NAME</u>	<u>NEEACTPHIL NO.</u>
AMCC Van Test Plan	26990-40218
AMCC Van Technical Manual	26990-40325
	<u>STEWART WARNER NO.</u>
Radio Transmitter Set AN/URT-23C(V)1	01A228010-01
Radio Transmitter T-827H/URT	01A228010-01
Maintenance Standard Book Radio Transmitting Set AN/URT-23C(V)1	-
	<u>GOULD NO.</u>
Group Signal Radio Converter AN/URA-17E	EE162-AH-OM1-010/ E110
	<u>NAVAIR NO.</u>
Power Supply 28 VDC Transformer Rectifier	19-45H-2
Air Conditioners/Heat Pumps	19-60-83
Air Transportable Integration Unit Mobile Facility	19-25-173
Mobile Facilities Log Book Inventory Record	-
	<u>DIGITECH NO.</u>
Instruction Manual for Model 2002-09 Digitech Analyzer/Generator	-
	<u>ARMY TM</u>
Dolly Set, Lift, Transportable Shelter Technical Manual Package XM832	-

# NAVAL SEA SYSTEMS COMMAND

## TEST EQUIPMENT

Description		U/I	QTY
28480-5328A-H99	Frequency Counter	EA	1
89536-8000A/BU	Digital Multimeter	EA	2
80009-2336	Oscilloscope	EA	1
70998-4410-025	FEEDTHRU Wattmeter	EA	1
28480-334A	Audio Distortion Analyzer	EA	1
Digitech Model 2002-08	TTY Test Set	EA	1
28480-3550B	Audio Test Set	EA	1
99899-4772-30	30dB Attenuator	EA	1
DA-412/U	Dummy Load	EA	1
28480-8640B-001-003	RF Signal Generator	EA	1
TS-3228/URA-38	Test Equipment	EA	1
TS-3229/URA-38	Test Equipment	EA	1

D29A

NAVAL OVERSEAS AIR CARGO  
TERMINAL (LARGE)

NAVSUP

J282U

## 1. MISSION

Provides personnel and facilities to process 13,500,000 pounds of air freight monthly. Processing includes palletizing, unpalletizing, handling and special treatment of hazardous cargo, distribution of in and outbound shipments by consignee, load planning, operation of ground support equipment, loading and unloading of trucks and aircraft, processing of necessary flight data and maintenance of records. This processing would be carried out on a three shifts per day, seven days per week basis. The maximum number of aircraft that can be worked at one time is three C-130s, or two C-141s or one C-5. The D29A storekeeper (SK) allowance is compatible with the mobilization allowance of two activated Naval Reserve NAVMTO Fleet Detachments.

2. PERSONNEL    5    Officers    76    Enlisted Men    Total    81

OFFICERS					ENLISTED MEN					
Ech	No	Rank	Desig	Billet Rate	Gp	Pay Gr	PNEC	SNEC	Title	
1	1	LT	3100	1265					FRT TRAF MGT	
1	1	LTJG	3100	1265					FRT TRAF MGT	
2	1	LCDR	3100	1205					Air Traffic	
2	1	LT	3100	1205					Air Traffic	
3	1	LT	3100	1215					Cargo Handling	
1	1				SK1	5	6		Storekeeper	
1	1				YN2	5	5		Yeoman	
1	2				CM2	7	5		Machinist's Mate	
1	1				EOC	8	7		Equipment Operator	
1	2				EO1	8	6		Equipment Operator	
1	5				EO2	8	5		Equipment Operator	
1	11				EOCN	3			Constructionman (EO)	
3	3				SKC	5	7		Storekeeper	
3	3				SK1	5	6		Storekeeper	
3	3				SK2	5	5		Storekeeper	
3	6				SK3	5	4		Storekeeper	
3	13				SN	6	3		Seaman	
3	19				SA	6	2		Seaman Apprentice	
3	6				EO3	8	4		Equipment Operator	

### 3. COST

NAVAIR	_____
SPAWAR	_____
NAVFAC	\$601,493
NAVSEA	\$ 348
NAVSUP	\$756,000
NSF	\$ 53,168
NAVFAC	
Identified (Other)	\$275,445

#### 4. CONSTRUCTION

Area required - 4.9 acres  
Prefab building - 70,000 sq ft  
Space requirements - Admin and Office - 1200 sq ft  
Storage (covered) - 68,800 sq ft  
Power required - 12KVA  
Internal roads - 14,000 sq yd  
Construction time - 28,591 Manhours

## 5. MATERIEL (MAJOR ITEMS)

Operations - 40x100 Bldgs  
Materials Handling Equipment  
Transportation - Trucks  
Hand Tools and Consumables  
Packaging Equipment and Supplies  
Office Equipment and Supplies  
Teletypewriters

WEIGHT: 1,284 long tons  
CUBE: 2,657 measurement tons

## NAVAL SUPPLY SYSTEMS COMMAND

### Sub-Function Codes

Ref		WT	CU
11	Administrative Equipment and Supplies	7,552	452
14	General Equipment and Supplies	38,085	1,516
75	CO2 Transfer and Cylinder Shop Equipment and Supplies	1,000	10
85	Fuel for heating	65,250	1,682
86	Fuel for vehicles and equipment under 32 deg	123,766	3,236
87	Fuel for vehicles and equipment over 32 deg	123,316	3,225
88	POL for under 32 deg	3,335	85
89	POL for over 32 deg	3,335	85
91	Materials handling equipment (463L MHE Provided By MAC)	666,000	34,506
	Truck Acft Cargo A/S 32H-6, 40,000 lbs (6ex)	282,000	9,600

# NAVAL SUPPLY SYSTEMS COMMAND (CONTINUED)

Ref		WT	CU
	Trailer Pallatized Cargo A/M 32H-6 (60ea)	108,000	7,200
	Truck Fork Lift A/S 32H-10, 10,000 lbs (6ea)	138,000	7,716
	Truck Fork Lift R/T 10,000 lbs (4ea)	90,000	8,400
	Kit - Flatbed Trailer (6ea)	48,000	1,590
99	Forms and Publications	57	4

## NAVAL FACILITIES ENGINEERING COMMAND

### FACILITIES

FACILITY OR GROUP	ASSEMBLY OR ECC		NORTH (TEMPERATE) TOTALS		
		QTY	WEIGHT LBS	CUBIC FT	
141 12E	Air Cargo Terminal	1	1,608,075.64	37,399.41	
812 30E	Electrical Distribution Lines-Ugnd	1	3,678.30	82.46	
832 10BP	Sanitary Sewer 4 Inch 300FT	1	641.98	46.69	
842 10AN	Water Distribution Line Potable	1	335.54	19.53	
843 10H	Fire Protection Pipeline	1	27,629.93	775.95	
851 10A	Road with Drainage 1 mile	1	44,988.00	1,947.00	

### CIVIL ENGINEER SUPPORT EQUIPMENT (CESE)

030731	Trk 3/4 Util	2	11,000.00	1,280.00
058812	Trk 5T Cargo M1	4	88,576.00	8,260.00
073101	Trk LDR AC HILF	1	22,700.00	1,500.00



## 1. MISSION

The F1 Cargo Handling Battalion (CHB) is a multi-mission unit comprised of 8 officers and 145 enlisted personnel plus the basic unit equipment required to provide technical and supervisory cargo handling capability to fleet and area commanders in support of world-wide naval operations. Unit equipment requirements beyond the basic allowance of personnel support equipment are provided to the cargo handling battalion by one or more of the supplemental equipment packages (F1A through F1G) described below. These supplemental equipment packages are tailored to the specific mission environment and to the specific requirements of the mission. The utilization of these supplemental equipment packages provide the fleet commanders a wide variety of options in utilizing the cargo handling battalions.

Units Assigned to the ABFC F1 Mission. The following units have the capability of being assigned to the ABFC F1 functional mission:

1. The Navy Cargo Handling and Port Group
2. The Naval Reserve Cargo Handling Training Battalion
3. Naval Reserve Cargo Handling Battalions

Both the Navy Cargo Handling and Port Group (NAVCHAPGRU) and the Naval Reserve Cargo Handling Training Battalion (NR CHTB) are active duty battalions and are always available. The Naval Reserve Cargo Handling Battalions (NR CHB's) are comprised solely of selected reserves and require a slightly longer time period to employ.

Cargo Handling Battalion Tasks. The specific tasks of a cargo handling battalion include, but are not limited to:

MPS/AFOE Cargo Handling. Providing skilled stevedores and command and control personnel capable of loading/discharging (either in-stream or pierside) commercial/MSC cargo ships associated with a maritime prepositioning ship (MPS) operation or an amphibious assault follow-on echelon (AFOE).

Heavy Lift Marine Crane Operators. Providing shipboard heavy lift crane operators for MPS, containership, auxiliary crane ship (TACS) and other specialized operations.

Total Cargo Class Responsibility. Providing stevedores and command and control personnel capable of loading/discharging all classes of cargo, including munitions, in a developed or non-developed port or in stream.

Limited Ocean Terminal. Providing managerial and technically skilled personnel capable of operating a limited marine cargo terminal in support of ship loading/discharging operations.

Limited Air Terminal. Providing managerial and technically skilled personnel capable of loading/discharging cargo from commercial and military aircraft and operating a limited air cargo terminal.

Self Supporting. Providing own services to sustain the administration, messing, berthing, limited construction, organizational level maintenance and repair requirements of the F1 ABFC unit.

Cargo handling battalions operate most effectively when employed solely in ship loading and discharge operations and when each of the 16 hatch teams is augmented by 7 unskilled (strongback) personnel from the supported activity. When augmented with 112 personnel (7 per hatch team) from the supported unit, the cargo handling battalion can achieve a 2880 measurement tons per day discharge rate alongside the pier and a 1920 measurement tons per day discharge rate in stream. If the cargo handling battalion is not augmented, then the discharge rates must be reduced by fifty per cent (1440 measurement tons at pierside and 960 measurement tons in stream).

The required number of cargo handling battalions (ABFC F1) units is directly dependent upon:

1. Tonnage to be handled.
2. Discharge scheduling and discharge rate desired.
3. Number of vessels/aircraft to be discharged/loaded.
4. Available pier and related facilities. (pierside operations)
5. Lighterage and related facilities (in-stream operations)
6. Available indigenous labor.
7. Available strongback labor augmentation.
8. Available mechanized cargo handling equipment (may be attained by utilizing a supplemental equipment package or combination of packages (F1A through F1G))

PLANNING ASSISTANCE AND MISSION DEVELOPMENT - The F1 Cargo Handling Battalion, and its associated supplemental equipment packages (F1A through F1G), provides the widest possible flexibility in the employment of cargo handling battalions. The Navy Cargo Handling and Port Group and the Naval Reserve Cargo Handling Battalion Regimental Staff (NR CHB REG STAFF) are available to provide fleet and area commanders with technical planning assistance in programming F1 Cargo Handling Battalions into specific mission scenarios.

For planning purposes the F1 Cargo Handling Battalion may be programmed with a variety of equipment packages tailored to specific mission scenarios as follows:

F1 - Cargo Handling Battalion Personnel and Core Equipment UCHBA

This package provides the personnel and the basic personal support equipment required to work all cargo handling situations. This package is required for all scenarios.

Supplemental Equipment Packages (added on to the basic F1 unit above to meet the environmental and mission requirements of specific missions):

F1A - Expanded Core Equipment Package UCHBB

This package provides the equipment necessary to support one Cargo Handling Battalion in mission scenarios other than the MPS scenarios. This equipment package must be provided to all Cargo Handling Battalions in all mission scenarios other than the MPS scenarios.

F1B - Cargo Handling CESE Package

UCHBC

This package provides the civil engineering support equipment (trucks, trailers, etc.) necessary to support a cargo handling battalion in establishing or augmenting a port. This package of equipment should be provided to a battalion in all ports where CESE is not locally available. (Note: This package provides the CESE for pier, terminal and local delivery operations. It does NOT provide a line haul capability).

F1C - Cargo Handling MHE Package

UCHBD

This package provides the NAVSUP materials handling equipment (forklifts, etc.) necessary to support an F1 Cargo Handling Battalion in a port where MHE is not locally available.

F1D - Container Handling Crane/Equipment Package

UCHBE

This package provides the mobile crane container handling forklift and supporting equipment necessary to support an F1 cargo handling battalion in a port that does not have locally available container handling facilities and where it is desired that the cargo handling battalion offload/load container ships and operate a container marshalling yard adjacent to the ocean terminal.

F1E - Air Cargo MHE Equipment Package

UCHBF

This package provides the equipment necessary to support one detachment of an F1 Cargo Handling Battalion in the operation of an air cargo terminal. This equipment package should be programmed into all scenarios where it is anticipated that the F1 Cargo Handling Battalion will be required to operate an air terminal. If air terminal operations will require more than one detachment of the F1 Cargo Handling Battalion then one F1E equipment package must be provided for each detachment.

F1F - Expeditionary Tent Camp Equipment

UCHBG

This package provides all the equipment necessary for one F1 Cargo Handling Battalion to establish and operate an austere expeditionary tent camp to provide berthing and messing for its personnel. This package of equipment should be provided to each F1 Cargo Handling Battalion in all scenarios where berthing or messing is not locally available or where berthing and messing is not provided by another activity or ABTC unit.

F1G - Camp Support CESE Equipment

UCHBH

This package provides the Civil Engineering Support Equipment (CESE) necessary to construct and maintain an austere expeditionary tent camp to billet and subsist one F1 Cargo Handling Battalion. This package contains only the camp support equipment. All other CESE equipment to be used in cargo handling operations is listed above under the F1B supplemental package.

## BASIC F1 CARGO HANDLING BATTALION MISSIONS

While the F1 Cargo Handling Battalion is a multi-mission unit with a wide variety of possible missions, there are three major mission scenarios which the battalion is normally programmed to accomplish.

### Maritime Prepositioning Ships (MPS) Support

The F1 Cargo Handling Battalion provides the personnel and equipment necessary to provide technical and supervisory cargo handling capabilities to fleet and area commanders in support of the Maritime Prepositioning Ships (MPS) program. The F1 component provides the skilled stevedores and command and control personnel capable of loading/discharging commercial and MSC ships in both an open ocean and pierside environment. Component personnel and organic equipment are transported by MAC as part of the Fly In Echelon (FIE) of the Navy Support Element (NSE) to the selected beach or port where the MPS squadron has been deployed. Each MPS squadron consists of 4 or 5 specially configured merchant ships which carry the majority of combat equipment and 30 days supplies for a Marine Amphibious Brigade (MAB). Hatch boxes with cargo handling equipment are prepositioned onboard each of the ships. Each MPS squadron requires two each F1 Cargo Handling Battalions to provide discharge of the cargo in the stream or pierside within the currently required timeframes. Each F1 Cargo Handling Battalion must be augmented with 112 USMC strongbacks if the discharge timeframes are to be met. Upon completion of the MPS offload, one of the F1 Cargo Handling Battalions may be retained on site to provide continuing/resupply cargo discharge services while the other cargo handling battalion may be redeployed to another cargo handling mission. Both cargo handling battalions will require additional equipment from one or more of the Supplemental Equipment Packages (F1A through F1G) depending on the subsequent mission assignments.

PLANNING GUIDANCE - MPS MISSION: Program the following packages for the MPS mission:

- A. 2 each F1 Cargo Handling Battalions for each MPS Squadron (no additional Supplemental Equipment Packages are required for the MPS mission)
- B. 224 strongback personnel from the supported unit (USMC) to augment the CHBs

### Assault Follow-On Echelon Mission Support

Each F1 Cargo Handling Battalion is capable of discharging cargo to support one half of a Marine Amphibious Brigade (MAB) within the required timeframes when augmented with the F1A Expanded Core Equipment Package. The required multiples of the F1 Cargo Handling Battalion (2 each CHBs for a MAB level AFOE and 4 each CHBs for a MAF level AFOE) plus the required quantities of the supplemental equipment packages (2 each F1A packages for the MAB level AFOE mission and 4 each F1A packages for the MAF level AFOE mission) provide the required technical and supervisory cargo handling capabilities to fleet and area commanders in support of USMC amphibious assault operation (MAB/MAF). The AFOE carries sufficient equipment and supplies to sustain 60 days of combat and consists of unit equipment and supplies which are not essential for the initial amphibious assault. Component

personnel and organic equipment accompany the AFOE to the area of operation. USMC personnel will augment the Fl Cargo Handling Battalion in the unskilled positions at the level of 224 augmentees for a MAB and 448 for a MAF level AFOE. The Naval Beach Group will provide required CESE, MHF and messing/berthing for the CHB, under the AFOE scenario by means of Table of Allowance Number 56 (TOA 56).

PLANNING GUIDANCE FOR AFOE MISSION - The number of Fl Cargo Handling Battalions and the required number of FlA supplemental equipment packages depend upon the size of the AFOE:

MAB Level AFOE requires:

- A. 2 each Fl Cargo Handling Battalions
- B. 2 each FlA Expanded Core Equipment Packages
- C. 224 strongback personnel from the supported unit

MAF Level AFOE requires:

- A. 4 each Fl Cargo Handling Battalions
- B. 4 each FlA Expanded Core Equipment Packages
- C. 448 strongback personnel from the supported unit

Port or Terminal Operation Augmentation of Establishment

The Fl Cargo Handling Battalion, when provided with the necessary supplemental equipment packages based upon the specific environment and the required strongbacks, provides the unit equipment, skilled stevedores and command and control personnel to augment or establish a port operation with a basic palletized cargo discharge rate of 2880 measurement tons per day. Specific tasks of the cargo handling battalion include, but are not limited to:

a. Cargo Handling

Providing stevedores and command and control personnel capable of offloading/discharging commercial and MSC ships, including munitions handling, in a developed port. When all palletized cargo handling operations are pierside the discharge rate will be 2880 measurement tons per day. When all cargo handling operations are in stream the discharge rate will be 1920 measurement tons per day.

b. Ocean Cargo Terminal

Providing 35 managerial and skilled technical personnel capable of operating a temporary ocean cargo terminal associated with the ship discharge. The maximum through put rate of the marine terminal will be 240 measurement tons per hatch team per day and the rate of the ship's discharge will be reduced accordingly.

c. Limited Air Terminal

Providing a detachment of 15 managerial and skilled personnel to operate a limited air cargo terminal. The detachment provides the battalion with the capability of sustaining around the clock operations at the limited air

cargo terminal. The establishment of the limited air cargo terminal will reduce the ship discharge rate to 2700 measurement tons per day pierside and to 1800 measurement tons per day in stream. The establishment of a limited air cargo terminal requires one FLE supplemental equipment package.

d. Crane Operators

Providing 32 heavy lift crane operators for containership, TACS vessels, or other special operations. The discharge rate of TACS vessel operations is 48 containers per day (12 hour) per hatch team pierside and 36 containers per day (12 hours) per hatch team in stream.

e. Mobile Shore/Container Crane Operations

Providing 12 mobile shore crane operators to offload containers pierside or to operate a terminal marshalling yard. The assignment of the mobile shore container crane task requires the addition of an FLD Container Handling Crane/Equipment Package to the Fl Cargo Handling Battalion.

f. Expeditionary Tent Camp

The Fl Cargo Handling Battalion is capable of providing its own messing, berthing and limited base support functions for short periods of time (less than 90 days) when provided with the FlF Expeditionary Tent Camp supplemental equipment package.

PLANNING GUIDANCE FOR PORT ESTABLISH/AUGMENT OPERATIONS - The following components must be programmed for each 2880 measurement tons of cargo desired discharged daily pierside and for each 1920 measurement tons of cargo desired discharged daily in stream:

1 each Fl Cargo Handling Battalion

1 each FIA Expanded Core Equipment Package

1 each FLD Cargo Handling CESE Equipment Package (must be provided only when adequate CESE equipment is not locally available in the port)

1 each FLC Cargo Handling MHE Equipment Package (must be provided only when adequate MHE is not locally available in the port)

1 each FLD Container Handling Crane/Equipment Package (must be provided if container handling operations are desired and container handling equipment is not available in the port)

1 each FLE Air Cargo MHE Equipment Package (must be provided when a limited air cargo terminal is planned and there is not sufficient air cargo MHE available locally)

1 each FlF Expeditionary Tent Camp Equipment Package (must be provided if messing and berthing is not locally available or is not being provided by another command)

# CARGO HANDLING BATTALION PRODUCTIVITY FACTORS

Note: All per hour are rounded to nearest .1 MT. All per 12 hour  
Figures are rounded to nearest 5 MT.

<u>Pier discharge</u>	<u>Per Hour</u> <u>Hatch Team (14 man)</u>	<u>Per</u> <u>12 Hour Per</u> <u>Team (14 man)</u>
Palletized Cargo	15 MT	180 MT
Break Bulk Cargo	6.2 MT	75 MT
Mixed Cargo	10.6 MT	130 MT
<u>Pier Ship Loading</u>		
Palletized Cargo	8.6 MT	105 MT
Break Bulk Cargo	4.1 MT	50 MT
Mixed Cargo	6.4 MT	75 MT
<u>In Stream Ship Discharge</u>		
Palletized Cargo	10.00 MT	120 MT
Break Bulk Cargo	5.6 MT	70 MT
Mixed Cargo	7.8 MT	95 MT
<u>In Stream Ship Loading</u>		
Palletized Cargo	6.7 MT	80 MT
Break Bulk Cargo	3.6 MT	45 MT
Mixed Cargo	5.7 MT	60 MT
<u>Container, TACS, Jumbo Rig, Heavy Lift Operations</u>		
Pier Load and/or Discharge	4 Containers (126 MT)	48 Containers (1536 MT)
Stream Load and/or Discharge	3 Containers (96 MT)	36 Containers (1152 MT)
<u>Ocean Terminal (Palletized Cargo)</u>		
Through Put (Receive and Issue)	20 MT	240 MT
One Way (Receive or Issue)	40 MT	480 MT
<u>Air Terminal</u> (Measured in pounds vice MT) (463L max weight=10,000lbs)	6666 LBS (1 463 Plt)	80,000 LBS (10-11 463L Plt)
<u>Pier Operation</u>	45 MT	540 MT

## Cargo Handling Battalion Utilization Tables

### Notes

1. 16 hatch teams assumes augmentation of 112 strongbacks (7 per hatch team). Without augmentation, the cargo capacity is reduced by 50%.
2. Above figures assume unitized (completely on pallets) cargo. Rough conversion factors for other classes of cargo are:
  - a. Break Bulk = 50% of the palletized cargo capacity
  - b. Mixed Cargo = 75% of the palletized cargo capacity
3. Ship operations - Divide hatch team by 4 to determine the number of hatch teams working each ship on each shift (eg. 2 ship 16 hatch teams means 4 hatch teams per shift per ship).

### Ship Discharge for Palletized Cargo (in measurement tons)

	Pier Side	In Stream	Pier Team	Ocean Terminal	Air Terminal
2 ship	2080 MT (16 HT)	0	0	0	0
2 ship	2160 MT (12 HT)	0	2160 MT (4 HT)	0	0
1 ship	1440 MT (8 HT)	0	1620 MT (3 HT)	1200 MT (5 HT)	0
1 ship	1260 MT (7 HT)	0	1620 MT (3 HT)	1200MT (5 HT)	80,000 lbs (1 HT)
2 ship	0	1920 MT (16 HT)	0	0	0



Ship loading of Palletized Cargo  
(in measurement tons)

	Pier Side	In Stream	Pier Team	Ocean Terminal	Air Terminal
2 ship	1680 MT (16 HT)	0	0	0	0
2 ship	1365 MT (13 HT)	0	1620 MT (3 HT)	0	0
1 ship	1050 MT (10 HT)	0	1080 MT (2 HT)	960 MT (4 HT)	0
1 ship	1050 MT (10 HT)	0	1080 MT (2 HT)	720 MT (3 HT)	80,000 lbs (1 HT)
2 ship	0	1280 MT (16 HT)	0	0	0

Container Loading and Discharge  
(measured in number of containers)  
(using TACS, MPS, shore crane, etc)

	Pier Side	In Stream	Pier Team	Ocean Terminal	Air Terminal
2 ship	768 (16 HT) (24,576 MT)	0	0	0	0
2 ship	576 (12 HT) (18,432 MT)	0	576 (4 HT) (18,432 MT)	0	0
2 ship	432 (9 HT) (13,824 MT)	0	432 (3 HT) (13,842 MT)	432 (4 HT) (13,824 MT)	0
2 ship	584 (8 HT) (12,288 MT)	0	432 (3 HT) (13,824 MT)	432 (4 HT) (13,824 MT)	80,000 lbs (1 HT) (50 MT)
2 ship		576 (16 HT) (18,432 MT)			

### Personnel Assignments

Available = 145 (CHB) + 112 (stongback augmentees) = 257 for 2 ships, 2 shifts

#### Hatch Team (224 personnel)

Hatch Captain	1
Hold Boss	1
Crane/Winch Operator	2
Signalman	1
Forklift Operator	2
Stevedores (Augmented)	7

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14 per hatch team

#### Personnel Assignments (continued)

##### b. Command and Control (14)

Technical Supervisor	1
Ship Supervisor	2
Status Center Watch	2
Communications/Security	2
Duty Corpsman	2

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9 per shift = 14 per battalion

##### c. Support Personnel

Mechanics	2
Corpsmen	2
Cooks	7
Camp Support	4
Administration	2

---

17 per battalion

**BASE SUPPORT.** While the cargo handling battalion is capable of limited austere self support for extended periods of time it is more desirable for the area or base headquarters organization to provide housing, messing, medical and welfare support for operations of greater than 90 day duration. When the cargo handling battalion will not be supported by a base organization and will be required to operate for more than 90 days in an isolated area, order the following components:

Housing and messing - Appropriate N (Tent Camp) component to support specific operations.

Ships Store - Use appropriate D24 series (Ship Store Facilities)

Medical Facilities - Use M15E (Dispensary, 10-bed, Mobile) component and M17E (Dental, Mobile) component if required.

Motion Pictures - Use N23 (Motion Picture Projection) component for film operation and exchange with ships or local activities.

Trucking - The F1 ABFC provides trucking assets over short distances (less than ten miles) from the pier/beach to the ocean terminal. If longer line haul trucking support is desired, a P17 Trucking Unit should be programmed.

2. PERSONNEL 8 Officers 145 Enlisted Men Total 153

OFFICERS						ENLISTED MEN				
Ech	No	Rank	Desig	Billet	Rate	Gp	Pay Gr	PNEC	SNEC	Title
1	1	CDR	3105							Commanding Officer
1	1	LCDR	3105							Executive Officer
1	1	LCDR	3105							Operations Officer
1	1	LT	3105							Ops Watch/Training Off
1	1	LT	3105							Ops Watch/Shipload Off
1	1	LT	3105							Air Cargo/Comm Off
1	1	LT	3105							Marine Term/Security Off
1	1	LT	3105							Engineering/Facilities Off
1	2			ABH2			5			Air Cargo/Forklift Driv
1	2			BMCS			8			Tech Cargo Supervisor
1	6			BMC			7			Hatch Captain
1	10			BM1			6			Hatch Captain
1	2			BM1			6			Hold Boss
1	12			BM2			5			Hold Boss
1	16			BM3			4			Signalman
1	20			BM3			4			Winch/Crane Operator
1	1			BU1			6			Facilities Supervisor
1	2			BU3			4			Builder/Forklift Driv
1	2			CE2			5			Watch Electrician/Forklift
1	2			CE3			4			Duty Electrician/Forklift
1	1			CMC			7			Transportation Supvr
1	1			CN1			6			Maint Shop Supvr/Fork Dr
1	2			CM2			5			Maint Watch Supvr/Fork Dr
1	4			CM3			4			Mechanic/Driver/Fork Dr
1	2			EO2			5			Dispatcher/Driver
1	2			EO3			4			Driver/Equip Operator
1	1			GM2			5			Armorer/Security Supvr
1	2			HM2			5			Medical Duty Supvr
1	2			HM3			4			Duty Corpsman
1	1			MSC			7			Messing Supervisor
1	2			MS1			6			Galley Watch Captain
1	4			MS3			4			Galley Watch Cook
1	1			SKCS			8			Terminal Supervisor
1	2			SK1			6			Hold Boss/Document Supvr
1	4			SK2			5			Winch/Crane Oper/Document
1	2			SK2			5			Pier Boss
1	8			SK3			4			Winch/Crane Operator
1	16			SK3			4			Forklift Driver/Documntor
1	4			SK3			4			Pier Driver/forklift Dr
1	1			UT2			5			Plumber/Facilities Maint
1	1			YN1			6			Administrative Div Supr
1	1			YN2			5			Office Supr/Status Ctr Wat
1	1			YN2			5			Clerk/Personnel Asst
1	3			YN3			4			Clerk/Status Ctr Watch

### 3. COST

NAVAIR	
SPAWAR	\$ 1,628
NAVFAC	\$ 2,990,928
NAVSEA	\$ 97,176
NAVSUP	\$ 1,052,229
NSF	\$ 258,169
NAVFAC	
Identified (Other)	\$ 40,554

#### 4. CONSTRUCTION

Tents or huts  
Area required - 5 acres  
Prefab building - 2,880 sq ft  
Space requirements for Admin and Office - 1920 sq ft  
Operations - 960 sq ft  
Power required 20 KW  
Internal roads and parking - 3,500 sq yds  
Total Component material - 693 LT's, 1,759 MT's  
Construction time - 516 M-Days

## 5. MATERIEL (MAJOR ITEMS)

Housing - Three 20 x 48 ft buildings  
Materials handling trucks  
Transportation  
Landing mat  
Ammunition handling equipment  
Spark proof hand tools  
Construction equipment and consumables  
Hand tools and consumables  
Office equipment and supplies

WEIGHT: U/D  
CUBE: U/D

## NAVAL SUPPLY SYSTEMS COMMAND

### Sub-Function Codes

Ref	Description	WT	CU
10	Damage and safety control material	243	8
11	Administrative equipment and supplies	14,472	777
12	Personnel equipment and sundries	5,461	744
14	General equipment and supplies	153,754	5,143
15	Communications equipment and supplies	80	5
19	Electronic equipment	23	.3
41	Non-medical support for medical & dental equip	1	.1
80	Ordnance support items	10,371	639
85	Fuel for heating	30,150	777

# NAVAL SUPPLY SYSTEMS COMMAND (CONTINUED)

Ref	Description	WT	CU
86	Fuel for vehicles and equipment under 32 deg	210,854	5,464
87	Fuel for vehicles and equipment over 32 deg	210,854	5,464
88	POL for under 32 deg	12,226	312
89	POL for over 32 deg	12,352	315
91	Material Handling equipment		
	Battery 18 cell 21 plate 36V - 29 ea	68,904	397
	Charger battery 36V - 6 ea	3,072	72
	Trailer platform 48 X 108 - 4 ea	4,000	324
	Truck, forklift diesel 4,000 lb RT - 14 ea	104,790	4,312
	Truck, forklift diesel 16,000 lb RT - 5 ea	150,000	10,650
	Truck, forklift electric 4,000 lb - 9 ea	112,500	2,700
	Truck, acft cargo 40,000 lb - 2 ea	94,000	3,200
	Truck, acft cargo 25,000 lb - 2 ea	46,000	2,572
99	Forms and publications	378	18

## NAVAL MEDICAL COMMAND

42	Medical Assembly M-360	1,431	94
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## NAVAL SEA SYSTEMS COMMAND

	U/I	QTY	WT	CU
Pistol, Cal 45 M1911A1	ea	8	*	*
Rifle 5.56MM, M16A1	ea	141	*	*

\*Weight and cube reflected by NAVSUP S/F 80  
Ammunition (Refer to NAVSEA Ammunition Allowance List 38736 and NAVSEA INST C8011.2. (Ammunition is handled separately from the component))

# NAVAL SEA SYSTEMS COMMAND (CONTINUED)

	U/I	QTY	WT	CU
High Dose Dosimeter IM-1431PD	ea	6	3	1
Casualty Dosimeter DT-60/PD	ea	307	18	-
Casualty Dosimeter CP-95( )PD	ea	2	100	6
Dosimeter Charger PP-354( )PD	ea	2	2	1
Long Range Survey Meter AN/PDR-27	ea	3	195	9
High Range Survey Meter AN/PDR-43	ea	3	36	1

## SPACE AND NAVAL WARFARE SYSTEMS COMMAND

<u>EQUIPMENT</u>	<u>PART NO.</u>	<u>QTY.</u>
Standard Communications		
Horizon Hand-Phone II		
Radio unit	HX200S	60
VHF Flexible Antenna	AT154	60
Ni-cad Battery Pack	CNB6	60
Wall Charger	CWC25	60
Earphone	EPI	60
Plastic case		60
Mini Lapel Speaker Mic	MP635G	60
Desk Top "Fast" Charger	CSA20	60
Ni-cad Battery Pack	CNB7	60
Waterproof Bag	EWA*	60

\*EWA is the brand name for this part. This brand of bag is recommended over the Standard Communications version.

<u>AN/PRC-77 Radio SET</u>		
Radio Receiver-Transmitter	5820-00-930-3724	13
Battery Box		13
Antenna	5820-00-889-3803	13
Antenna	5820-00-242-4967	13
Handset	5965-00-069-8886	13
Antenna Support	5985-00-086-7149	13
Electrical Equip. Harness	5820-00-892-8094	13
Cotton Duck Bag	5920-00-086-7138	13
<u>AN/PRC-113(V)-3 Radio Set</u>		
Radio Assembly RT-1319/URC	706738-803	4
Battery Case Assembly	914858-803	4
VHF Antenna	810552-801	4
UHF Antenna	812057-1	4
TCD Transfer Cable	812058-1	4
KY57 Baseband Cable	566083-808	4
Operator Handbooks	566084-808	4
Handset H-250/U GFE	5965-00-043-3463	4

## SPACE AND NAVAL WARFARE SYSTEMS COMMAND (CONTINUED)

<u>EQUIPMENT</u>	<u>PART NO.</u>	<u>QTY.</u>
Battery BA5590/U	6135-01-036-3463	8
Battery BB5590/U	6140-01-063-3918	24
Pack Frame	8465-00-001-6475	4
Field Pack	8465-01-019-9102	4
Battery Charger	PP7236	4
Antenna UHF/VHF	812059-1	4
<u>AN/PRC-104(V) Radio Set</u>	5820-01-141-7953	4
Rec.-Trans. RT-1209/URC	5820-01-141-7953	4
Amplifier AM-6874/PRC-104	5820-01-065-5044	4
Cable CY-8291/PRC-104(V)		4
Cable CX-7875/PRC-104	6135-01-080-2886	4
Cable CX-13030/PRC-104		4
Cable CX-13031/PRC-104		4
Charger Cable Assembly	6135-01-092-4807	4
Antenna AB-1241/PRC-104	5820-01-065-4495	4
Cable CG-3815/U	05869/755002A7114-1	4
Ant. Section AB-129/FR	5820-00-234-4127	4
Antenna AT-271A/PRC	5985-00-646-2365	4
Instruction Card		4
Cargo Support Shelf	8969-00-001-6476	4
Cargo Tiedown Strap	8465-00-001-6577	4
Pack Frame	8465-00-001-6475	4
Field Pack	8465-01-019-9102	4
Adapter UG-349 ()/U	5935-00-204-5110	4
Lithium Battery BA 5590	6135-01-036-3945	5
Storage Battery BA 590	6140-01-063-3918	16
Immers. Res. Loudspeaker	5965-00-876-2375	4
RF Cable Assembly	05869/755002B9016	4
Audio Cable Assembly	05869/755002B9017	4
Antenna AS-2259/GR	5985-00-106-6130	4
Handset H-250/U	5965-00-043-3463	4
Cable Assembly	05869/755002B9018	4
Battery Charger PP-7286	6130-01-141-3490	4
Universal Power Supply		4
<u>AN/VRC-46 Radio Set</u>	7G5820-00-223-7453	5
Rec.-Trans.	RT-524/VRC	5
Power Supply	PP-2953/U	5
Mntg Base MT-1029/VRC	5820-00-893-1323	5
Antenna Unit	AS-1729/VRC	5
Antenna Element	AT-1095/VRC	5
Antenna Element	AS-1730/VRC	5
Matching Unit/Base	MX-6707/VRC	5
NAVELEX Technical Manual	0967-467-3010	5
Cable Assembly CX-4722		5
Cable Assembly CX-4720		5
Loudspeaker LS-166/U	9N5965-00-243-6420	5



# SPACE AND NAVAL WARFARE SYSTEMS COMMAND (CONTINUED)

\*\*Cable assembly stock numbers and prices will vary with length. Exact lengths will need to be identified before stock numbers and prices can be quoted.

NOTE: The AN/VRC-46 radio operates on a 24 volt supply. Since NAVCHAPCRU vehicles operate with 12 volt systems, it is recommended that an extra 12 volt battery be purchased and installed in series with the existing battery in all vehicles requiring this radio.

## NAVAL FACILITIES ENGINEERING COMMAND

### FACILITIES

FACILITY OR GROUP	ASSEMBLY OR ECC		NORTH (TEMPERATE) TOTALS		
		QTY	WEIGHT LBS	CUBIC FT	
218 50TA	Battery Charging Shop Tactical	1	25,066.32	773.57	
610 10N	Administration Minimal	2	2,972.28	229.64	
723 20J	Head 4-Hole Burn Out w/soakage Pit	3	10,396.86	494.19	
812 30PE	Elec Distr Line 1000ft #6 EXPED	4	1,075.28	40.00	
852 10C	Parking Area 7000 SY	1	.00	.00	

### CIVIL ENGINEER SUPPORT EQUIPMENT (CESE)

036031	Trk 1 1/2 T Cargo	7	42,000.00	5,250.00
036131	Ambulance Heavy	1	7,475.00	1,053.00
058712	Trk 5T Dump MLL	1	22,640.00	1,620.00
058812	Trk 5T Cargo ML	2	44,768.00	4,130.00
060712	Trk 5T Trac ML	12	231,120.00	16,192.00
070921	Trk Fld Servng 4X2	1	14,110.00	1,450.00
074611	Trk Tank 1200 gal	3	43,875.00	4,035.00
081601	Semi 20-T Stake	10	109,000.00	13,560.00
082601	Semi 50-T Lobed	2	32,570.00	3,734.00
088002	Trlr TK 400 gal	5	14,000.00	3,250.00
453109	Loader Scoop (w/backhoe)	1	23,000.00	680.50
511022	Floodlight Set	8	30,400.00	3,984.00
512111	Gen 15KW Skid	2	6,000.00	105.00
512211	Gen 30KW Skid	1	3,500.00	60.00
821901	Crane Trk 140T	1	198,500.00	5,136.00
825302	Crane Trk 30T	1	72,200.00	5,720.00
---	Loader, Container, Front End	1	---	---
---	Top Pick			
---	Spreader, Semi-auto 20 ft	1	---	---
---	Spreader, Semi-auto 40 ft	1	---	---

### TOOL KITS

80013	Kit Mech Hand Tools f/2 Men	4	1,376.48	84.12
80015	Kit Battery Service Tools	1	516.98	11.82

## 1. MISSION

This is a mobile, shore-based facility that provides Intermediate Level Maintenance Repair Capability for a nine aircraft P-3 A/B Squadron deployed to an advance base for extended operations (greater than 30 days). If operations beyond 30 days but less than 90 days are expected at the deployment site and adequate Supply Lines of Communications (SLOC) are available, this ABFC need not necessarily be deployed in its entirety. Only those modules (elements) herein which provide the battery shop/s, support equipment, support equipment maintenance, oxygen/nitrogen recharging and pre-positioned codes P&E IMRL equipment capabilities are required. However, if adequate SLOC are not available or if operations are planned beyond 90 days, it should be fully deployed.

This ABFC is required on a one per site basis, if more than one squadron is to be supported, early visibility is required in order that the component can be tailored upward to support the additional workload. Additional spares and repair parts, and selected support equipment and personnel will be required, especially if the additional workload is generated by an off-station squadron/detachment.

This facility consists of sixty-one 20 ft by 8 ft by 8 ft mobile vans and a rapidly erectable, portable, arch-type building to house full avionics repair capability, including PME/CAL and micro-min repair, and selected airframe/power plant repair capability, necessary maintenance control, Supply Support Center, and administrative support spaces, technical library, maintenance forms and publications, adequate rotatable pool material and adequate OSI for maintenance of the facility. Selected airframe/power plant repair capabilities are:

a. Airframes - Essential hydraulic/pneumatic repair, non-destructive testing, tire disassembly/build-up, corrosion repair, welding, and sheet metal fabrication/repair. Oxygen/nitrogen will be separately provided in 400 gallon air-transportable containers with vaporization/cylinder recharging provided via a single mobile facility.

b. Power Plants - Engine repair capability includes Level III engine build-up, including replacement of turbine assemblies. QECA support includes one complete QECK to be fitted to a canned nude engine. The QECA provided in the squadron's 30 day contingency support package will become a supply asset of this component when collocated with the deployed squadron. Propeller repair capability consists of disassembly/build-up, repair of de-icer elements, dome re-seal, propeller control external leakage repair including propeller and seal plate build-up. One complete spare propeller (including propeller assembly and controls) is provided with this component. The build-up propeller provided in the squadron's contingency support package will become an asset of this component when collocated with the deployed squadron. Two spare gear reduction assemblies are included in this component. Auxiliary Power Unit (APU) maintenance will be limited to component or end item replacement only.

Battery shop includes capabilities for storing and servicing both NICAD and lead/acid types. An adequate initial supply of spare batteries of both types is included.

The component is composed of individual modules designed to provide support to specified systems/equipment and/or provide specific shop/work center support. The modules contain the mobile facilities, personnel, support equipment, ancillary equipment, and parts/materials necessary to provide intermediate level maintenance support for the aircraft systems/equipments intended. Modularization of this component allows a phased build-up thus minimizing the necessity for massive initial transport requirements.

This component, when added to the P-3 Squadron (Common) Support ABFC, if required, and the squadron's organic capability, will provide all necessary maintenance support for a single VP squadron operating at projected wartime flight hours.

This component is composed of 12 modules capable of specified functions in the intermediate maintenance support of P-3 aircraft systems and airborne equipments. Missions of each of the modules, their recommended assigned Unit Types Codes (UTC), number of mobile facilities, and approximate weight and cube are described as follows:

TITLE	MISSION	UTC	No. MFs	WT(LT)	CU(MT)
Mechanical Support Module.	Includes	9523A	14	142.4	512.0
following capabilities -					
Tire Shop	Provides wheel and tire maintenance for aircraft and support equipment.				
Airframes	Provides metal and fiberglass repair, hydraulic component repair and welding, machine and survival equipment shops.				
Power Plant/ Propeller Shop	Provides gearbox/torquemeter limited maintenance of power section, auxiliary power unit (APU) limited component/end item replacement, and over/on-the-wing turbine/gearbox replacement. *Note 2.				
Non-Destructive Inspection (NDI)	Provides aircraft and support equipment non-destructive inspection.				
Support Equipment/MF Maintenance shops	Provides servicing and repair of support equipment (other than avionics) used by organizational and intermediate levels of maintenance of MFs and associated ancillary equipment. *Note 2				
Battery Shop Support Module.	Includes	9523C	2	17.8	64.0
following capabilities -					
Provides lead-acid and NICAD battery handling, storage, servicing and recharging.					

Production Control, Technical Library, Tool Room Support Module. Includes following capabilities -	9523P	3	25.7	96.0	Provides administration/control of maintenance, storage/maintenance of technical data, working space for Quality Assurance personnel, and secure storage/issue of tools and other equipment.
Liquid Oxygen/Nitrogen Support Module. Includes following capabilities -	9523R	1	3.9	32.0	Provides for generation and distribution of gaseous oxygen and nitrogen.
Supply Support Modules. Includes following capabilities -	9523L	11	116.6	664.9	Provides management and compartmentalized storage of AVCAL/GSI material and upline asset and functional capabilities management information. *Note 3.
Radar/ESM/IRDS Support Modules. Includes following capabilities -	9523N	3	26.7	96.0	Provides test, check and repair of radar/ESM/IRDS systems and associated equipment.
COM/NAV Support Module. Includes following capabilities -	9523P	3	26.7	96.0	Provides COM/NAV (including communications security EQ) and associated equipment test and check of repair.
INS Support Module. Includes following capabilities -	9523Q	1	8.3	32.0	Provides inertial navigation systems, electrical instruments and associated equipment test, check and repair.
ASW Support Modules. Includes following capabilities -	9523R	2	17.8	64.0	Provides ASW systems test, check and repair.
PME Calibration Support Module. Includes following capabilities -	9523T	6	53.4	192.0	Provides test equipment repair and Type IV field calibration.
ATE Support Modules. Includes following capabilities -	9523V	6	53.4	192.0	Provides test, check and repair of general avionics equipment supported by the AN/USM-449.

Micro-Min Support Module. Includes 9523X 1 8.9 32.0  
following capabilities -

Provides test, check and repair of general  
avionics equipment.

NOTE: (1) Integration Units may or not be required when developing individual  
modules, depending upon deployment site facilities available.  
There are eight integration units assigned to each complex. Weight  
and cube of each unit is 8.9 LT and 32 MT, and the total weight and  
cube is 71.2 and 256 MT.

(2) Additionally, a separate rapidly erectable and relocatable building  
is included to be shared by the Power Plant/Propeller and Support  
Equipment Shops. The building is a rigid frame, membrane covered  
type structure which is currently under development. Weight and  
cube is included in the Power Plant and Propeller Shop Module  
(17.8 LT and 64.0 MT).

(3) Weight and cube includes 18.7 LT and 143.9 MT for items too large  
for storage in mobile facilities.

## 2. PERSONNEL:

2 Officers and 60 Enlisted - Total 62

Manning requirements for mobilization are under development.

## 3. COST U/D

NAVAIR	_____
NAVFAC	\$126,033
NAVSUP	_____
NAVFAC	
Identified (Other)	\$ 82,136

## 4. CONSTRUCTION

Area - .5 acres

Power - 36 KVA

Construction Time - 525 Man Hours

## 5. MATERIEL. (MAJOR ITEMS ONLY)

		CONTRIBUTING SYSCOM
Mobile Facilities	(61 ea)	AIR
Ancillary Equip		
Running Gear	(6 ea)	AIR
Jacks	(24 ea)	AIR
Slings	(2 ea)	AIR

5. MATERIAL (MAJOR ITEMS ONLY) (CONTINUED)

Electrical Power		
60 Hz, 60kw	(4 ea)	AIR
60 Hz, 200kw	(2 ea)	AIR
400 Hz, 7.5kw	(7 ea)	AIR
Portable Buildings		
Aircraft Support Shop	(1 ea) U/D	FAC
Head Facility	(1 ea)	FAC
Truck, 1/2 Ton Utility	(2 ea)	FAC
Truck, 2 1/2 Ton Cargo	(1 ea)	FAC
Truck, 1 1/2 Ton T4	(2 ea)	FAC
Forklift, 10 Ton	(1 ea)	SUP
Miscellaneous TBA Items		SUP

WEIGHT: Approximately 579.4 long tons

CUBE: Approximately 2328.9 measurement tons

NAVAL FACILITIES ENGINEERING COMMAND

FACILITIES

FACILITY OR GROUP	ASSEMBLY OR ECC	NORTH (TEMPERATE) TOTALS		
		QTY	WEIGHT LBS	CUBIC FT
211 70B	Aircraft Support Shop 40X70	1	28,279.81	1,587.04
723 20X	Head Burn Out Four Hole w/Urinal	2	4,528.70	240.78
811 10AE	Elec Pwr Plant Dsl 1-30KW w/Plwtank	1	5,764.44	135.58
812 30DH	Elec Distr Line 1500FT Ugdnd #1	1	649.48	9.09

CIVIL ENGINEER SUPP AT EQUIPMENT (CESE)

030731	Trk 3/4T Util	2	11,000.00	1,280.00
058812	Trk 5T Cargo ML	1	22,144.00	2,063.00
088002	Trlr Tk 400G SS	2	5,600.00	1,300.00

## 1. MISSION

This is a mobile, shore-based facility that provides Intermediate Level Maintenance Repair Capability for a nine aircraft P-3C Squadron deployed to an advance base for extended operations (greater than 30 days). If operations beyond 30 days but less than 90 days are expected at the deployment site and adequate Supply Lines of Communications (SLOC) are available, this ABFC need not necessarily be deployed in its entirety. Only those modules (elements) herein which provide the battery shop/s, support equipment, support equipment maintenance, oxygen/nitrogen recharging and pre-positioned codes P&E IMRL equipment capabilities are required. However, if adequate SLOC are not available or if operations are planned beyond 90 days, it should be fully deployed.

This ABFC is required on a one per site basis, if more than one squadron is to be supported, early visibility is required in order that the component can be tailored upward to support the additional workload. Additional spares and repair parts, and selected support equipment and personnel will be required, especially if the additional workload is generated by an off-station squadron/detachment.

This facility consists of sixty-two 20 ft by 8 ft by 8 ft mobile vans and a rapidly erectable, portable, arch-type building to house full avionics repair capability, including PME/CAL and micro-min repair, and selected airframe/power plant repair capability, necessary maintenance control, Supply Support Center, and administrative support spaces, technical library, maintenance forms and publications, adequate rotatable pool material and adequate OSI for maintenance of the facility. Selected airframe/power plant repair capabilities are:

a. Airframes - Essential hydraulic/pneumatic repair, non-destructive testing, tire disassembly/build-up, corrosion repair, welding, and sheet metal fabrication/repair. Oxygen/nitrogen will be separately provided in 400 gallon air-transportable containers with vaporization/cylinder recharging provided via a single mobile facility.

b. Power Plants - Engine repair capability includes Level III engine build-up, including replacement of turbine assemblies. QECA support includes one complete QECK to be fitted to a canned nude engine. The QECA provided in the squadron's 30 day contingency support package will become a supply asset of this component when collocated with the deployed squadron. Propeller repair capability consists of disassembly/build-up, repair of de-icer elements, dome re-seal, propeller control external leakage repair including propeller and seal plate build-up. One complete spare propeller (including propeller assembly and controls) is provided with this component. The build-up propeller provided in the squadron's contingency support package will become an asset of this component when collocated with the deployed squadron. Two spare gear reduction assemblies are included in this component. Auxiliary Power Unit (APU) maintenance will be limited to component or end item replacement only.

Battery shop includes capabilities for storing and servicing both NICAD and lead/acid types. An adequate initial supply of spare batteries of both types is included.

The component is composed of individual modules designed to provide support to specified systems/equipment and/or provide specific shop/work center support. The modules contain the mobile facilities, personnel, support equipment, ancillary equipment, and parts/materials necessary to provide intermediate level maintenance support for the aircraft systems/equipments intended. Modularization of this component allows a phased build-up thus minimizing the necessity for massive initial transport requirements.

This component, when added to the P-3 Squadron (Common) Support ABNC, if required, and the squadron's organic capability, will provide all necessary maintenance support for a single VP squadron operating at projected wartime flight hours.

This component is composed of 13 modules capable of specified functions in the intermediate maintenance support of P-3 aircraft systems and airborne equipments. Missions of each of the modules, their recommended assigned Unit Types Codes (UTC), number of mobile facilities, and approximate weight and cube are described as follows:

TITLE	MISSION	UTC	No. MFs	WT(LT)	CU(MT)
Mechanical Support Module.	Includes	9524A	14	142.4	512.0
following capabilities -					
Tire Shop	Provides wheel and tire maintenance for aircraft and support equipment.				
Airframes	Provides metal and fiberglass repair, hydraulic component repair and welding, machine and survival equipment shops.				
Power Plant/ Propeller Shop	Provides gearbox/torquemeter limited maintenance of power section, auxiliary power unit (APU) limited component/end item replacement, and over/on-the-wing turbine/gearbox replacement. *Note 2.				
Non-Destructive Inspection (NDI)	Provides aircraft and support equipment non-destructive inspection.				
Support Equipment/MF Maintenance shops	Provides servicing and repair of support equipment (other than avionics) used by organizational and intermediate levels of maintenance of MFs and associated ancillary equipment. *Note 2				
Battery Shop Support Module.	Includes	9524B	2	17.8	64.0
following capabilities -					
Provides lead-acid and NICAD battery handling, storage, servicing and recharging.					



Productive Control, Technical Library, Tool Room Support Module. Includes following capabilities -	9524F	3	26.7	96.0	Provides administration/control of maintenance, storage/maintenance of technical data, working space for Quality Assurance personnel, and secure storage/issue of tools and other equipment.
Liquid Oxygen/Nitrogen Support Module. Includes following capabilities -	9524H	1	8.9	32.0	Provides for generation and distribution of gaseous oxygen and nitrogen.
Supply Support Modules. Includes following capabilities -	9524L	11	116.6	664.9	Provides management and compartmentalized storage of AVCAL/OSI material and upline asset and functional capabilities management information. *Note 3.
Radar/ESM/IRDS Support Modules. Includes following capabilities -	9524N	3	26.7	96.0	Provides test, check and repair of radar/ESM/IRDS systems and associated equipment.
COM/NAV Support Module. Includes following capabilities -	9524P	3	26.7	96.0	Provides COM/NAV (including communications security HQ) and associated equipment test and check of repair.
INS Support Module. Includes following capabilities -	9524Q	1	8.9	32.0	Provides inertial navigation systems, electrical instruments and associated equipment test, check and repair.
ASW Support Modules. Includes following capabilities -	9524R	2	17.8	64.0	Provides ASW systems test, check and repair.
PME Calibration Support Module. Includes following capabilities -	9524T	6	53.4	192.0	Provides test equipment repair and Type IV field calibration.
ATE Support Modules. Includes following capabilities -	9524V	6	53.4	192.0	Provides test, check and repair of general avionics equipment supported by the AN/USM-449.
Micro-Min Support Module. Includes following capabilities -	9524X	1	8.9	32.0	Provides test, check and repair of general avionics equipment.

Armament and Photo Repair Support Module. 9524Y 1 8.9 32.0  
Includes following capabilities -

Provides test, check and repair of armament systems, photo reconnaissance and associated equipment.

NOTE: (1) Integration Units may or may not be required when developing individual modules, depending upon deployment site facilities available. There are eight integration units assigned to each complex. Weight and cube of each unit is 8.9 LT and 32 MT, and the total weight and cube is 71.2 LT and 256 MT.

(2) Additionally, a separate rapidly erectable and relocatable building is included to be shared by the Power Plant/Propeller and Support Equipment Shops. The building is a rigid frame, membrane covered type structure which is currently under development. Weight and cube is included in the Power Plant and Propeller Shop Module (17.8 LT and 64.0 MT).

(3) Weight and cube includes 18.7 LT and 143.9 MT for items too large for storage in mobile facilities.

## 2. PERSONNEL:

2 Officers and 60 Enlisted - Total 62

Manning requirements for mobilization are under development.

## 3. COST

NAVAIR	-
NAVFAC	\$126,033
NAVSUP	-
NAVFAC	
Identified (Other)	\$ 82,136

## 4. CONSTRUCTION

Area Req'd - .5 acres  
Power - 36 KVA  
Construction Time - 525 Man Hours

## 5. MATERIEL (MAJOR ITEMS ONLY)

		CONTRIBUTING SYSCOM
Mobile Facilities	(62 ea)	AIR
Ancillary Equip		
Running Gear	(6 ea)	AIR
Jacks	(24 ea)	AIR
Slings	(2 ea)	AIR

# 5. MATERIEL (MAJOR ITEMS ONLY) (CONTINUED)

Electrical Power		
60 Hz, 60kw	(4 ea)	AIR
60 Hz, 200kw	(2 ea)	AIR
400 Hz, 7.5kw	(7 ea)	AIR
'I' Level Support/Test Equipment (IMRL)		AIR
Meteorology/Calibration Equipment		AIR
Technical Publications		AIR
90 Day Wartime AVCAL/OSI		SUP (ASO)
30 Day CSP		
ABC WDSP		
Portable Buildings		
Aircraft Support Shop	(1 ea) U/D	FAC
Head Facility	(1 ea)	FAC
Truck, 1/2 Ton Utility	(2 ea)	FAC
Truck, 2 1/2 Ton Cargo	(1 ea)	FAC
Truck, 1 1/2 Ton T4	(2 ea)	FAC
Forklift, 10 Ton	(1 ea)	SUP
Miscellaneous TBA Items		SUP

WEIGHT: Approximately 588.3 long tons  
 CUBE: Approximately 2360.9 measurement tons

## NAVAL FACILITIES ENGINEERING COMMAND

### FACILITIES

FACILITY OR GROUP	ASSEMBLY OR ECC		NORTH (TEMPERATURE)	TOTALS
		QTY	WEIGHT LBS	CUBIC FT
211 70B	Aircraft support shop 40X70	1	28,279.81	1,587.04
723 20X	Head burn out four hole w/urinal	2	4,528.70	240.78
811 10AE	Elec pwr plant dsl 1-30KW w/plwtnk	1	5,764.44	135.58
812 30DH	Elec dist line 1500 ft ugnd #1	1	649.48	9.09

### CIVIL ENGINEER SUPPORT EQUIPMENT (CESE)

030731	Trk 3/4T util	2	11,000.00	1,280.00
058812	Trk 5T cargo ml	1	22,114.00	2,065.00
088002	Trlr TK 400G ss	2	5,600.00	1,300.00

H14E

## AVIATION TANK FARM (BASIC)

NAVFAC

NAO1U

## 1. MISSION

Provides storage for jet fuel and aviation gasoline to refuel aircraft and aircraft refuelers with uncontaminated fuel. The tank farm provides for 50,000 barrels of jet fuel and 3,000 barrels of aviation gasoline. It includes tanker mooring, sea loading lines, booster and delivery pumps, fuel servicing units, and both center point and over wing dispensing nozzles.

Heat is required for diesel fuel only in northern installations. In addition heaters are provided for northern installations where temperatures fall below 32 deg F. To prevent freezing of water collected in the receiving filter sumps and filter separator dispensing equipment.

One 8 inch and two 6 inch sea loading lines are provided, one for diesel fuel, one for aviation gasoline and one for jet fuel, each rated at 857 barrels per hour.

Four 300/600 GPM fuel dispensing filter-separators with both center point and over wing dispensing nozzles are provided.

The P12A Component should be provided when local facilities do not afford adequate fire protection. A foam generating system is provided.

Quick disconnect couplings are provided for cross connection with the Marine Amphibious Assault Fuel Systems and Tactical Airfield Dispensing System.

2. PERSONNEL    1   Officers    12   Enlisted Men    Total    13

OFFICERS						ENLISTED MEN				
Ech	No	Rank	Decig	Billet	Rate	Gp	Pay Gr	PNEC	SNEC	Title
2	1	LTJG	3100	1946						Fuel Depot
2	1				SK1	5	6			Storekeeper
2	1				SK2	5	5			Storekeeper
2	1				CM1	8	6			Const mechanic
2	2				CN	8	3			Constructionman
2	1				UTC	8	7	6117		Utilitiesman
2	1				UT1	8	6	6117		Utilitiesman
2	1				UT1	8	6		9561	Utilitiesman
2	2				UT2	8	5	6117		Utilitiesman
2	?				UT3	8	4	6117		Utilitiesman

### 3. COST

NAVAIR	_____
SPAWAR	_____
NAVFAC	\$1,820,775
NAVSEA	_____
NAVSUP	_____
NSF	\$ 20,290
NAVFAC	
Identified (Other)	\$ 894,131

### 4. CONSTRUCTION

Area required - 15 acres  
 Prefab building - 960 sq ft  
 Piers, causeways, pontoons - 2,116 sq ft  
 Spaces requirements - Admin and offices - 480 sq ft  
                                     Operations - 480 sq ft  
 POL Storage - 50,000 bbl  
 Power required - 48 KVA  
 Internal roads and parking - 24,000 sq yds  
 Construction Time - 35,115 Man Hours

#### NAVAL SUPPLY SYSTEMS COMMAND

##### Sub-Function Codes

Ref	Description	WT	CU
10	Damage and safety control material	407	15
11	Administrative equipment and supplies	51	3
14	General equipment and supplies	1146	44
85	Fuel for heating	9900	255
86	Fuel for vehicles and equipment under 32 deg	134514	3445
87	Fuel for vehicles and equipment over 32 deg	126864	3248
88	POL for under 32 deg	5972	154
89	POL for over 32 deg	5032	120
99	Forms and publications	10	1

#### NAVAL FACILITIES ENGINEERING COMMAND

##### FACILITIES

##### FACILITY ASSEMBLY OR GROUP OR ECC

##### NORTH (TEMPERATE) TOTALS

	QTY	WEIGHT LBS	CUBIC FT
121 10A Aircraft Direct Fueling Station	4	26,531.16	2,262.56
121 20A Aircraft Truck Fueling Facility	4	60,957.88	2,791.40
125 10A Pol Pipeline Sealanding 8 inch	1	138,834.70	5,120.60
125 10J Amphibious Assault Sub Fuel Line 64	2	227,206.30	16,365.94
125 10TF Tank Farm Details	1	.00	.00
125 10W Pol Pipeline JP-5 Product	1	138,190.56	2,350.69
125 10X Pol Pipeline Diesel Product	1	48,654.70	679.17
125 10Y Pol Pipeline Avgas Product	1	54,214.90	760.21

# NAVAL FACILITIES ENGINEERING COMMAND (CONTINUED)

## FACILITIES (CONTINUED)

FACILITY ASSEMBLY OR GROUP OR ECC		QTY	WEIGHT LBS	CUBIC FT
125 16A	Pumping Station Pol 6N W/One 600GPM PMP	4	26,602.00	1,233.48
125 16C	Pumping Station Pol 8N W/One 600GPM PMP	7	54,652.01	2,209.20
125 16E	Filter Separator Station 600 GPM	8	81,570.32	4,134.56
125 16F	Pumping Sta Pol 6N W/One 350GPM PMP	1	7,988.37	263.57
143 75B	Pol Operations/Smplg/Test ng Bldg	1	40,275.67	1,677.89
218 65B	Shelter WD Frame Gen Purp 18X33 FT	2	14,800.42	361.32
218 65C	Shelter WD Frame 12X16FT (Enclose)	5	24,136.45	785.85
411 20A	Aviation Gasoline Storage 3000B BBL	1	57,014.64	1,258.23
411 30B	Pol Storage 1000 BBL	1	30,091.55	737.40
411 50A	Fuel Storage 10000 BBL	5	708,706.40	12,302.57
811 10AA	Elec Pwr Plant DSL 1-15KW W/Plwtnk	1	4,942.28	126.48
811 10BA	Floodlight Diesel 5KW	4	15,200.00	1,992.00
812 30FA	Elec Distr Line 1000FT #8 Exped	1	160.00	20.00
843 10J	Fire Protection Pipeline Tank Farm	1	79,788.77	1,344.76
843 10T	Fire Protect Pipeline Foam Gen Sys	2	42,114.88	1,217.10
843 20D	Fire Protection Pumpg Sta 500 GPM	3	14,390.67	509.10
843 35A	Fire Protection Reservoir	1	4,186.62	173.72
851 10A	Road With Drainage 1 Mile	1	44,988.00	1,947.00

## CIVIL ENGINEER SUPPORT EQUIPMENT (CESE)

036031	Trk 1 1/2 Cargo	1	6,000.00	750.00
088002	Trlr Tk 4000 SS	1	2,800.00	650.00

## TOOL KITS

80001	Kit Plumbers F/4 Men	1	316.75	8.32
80003	Kit Tank Erection F/4 Men	1	878.42	24.65
80013	Kit Mech Hand Tools F/2 Men	1	344.62	21.03
81007	Kit Miscellaneous Tools	1	358.52	27.53

## WATERFRONT, SMALL CRAFT AND MARINE EQUIPMENT

991 23A	Barge Pontoon 4X12 W/12-1/2T Crane	1	188,007.38	13,908.68
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## INITIAL OPERATIONAL SUPPLIES

60000	Kit Test Petroleum	1	107.36	2.08
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## PERSONNEL RELATED SUPPLIES

67501	Kit Respirator	1	59.35	7.60
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Weight - 1170 Short Tons

Cube: 1900 Measurement Tons

% Containerizable: 94%

Est. Aircraft Loads: 52 C141 loads plus 1 C5 load

H14K

## HIGH SPEED FUEL DISPENSING SYSTEM

NAVFAC

NA05U

## 1. MISSION

Provides a hydrant-type refueling system to supplement or replace tank trucks for refueling of carrier, patrol, or helicopter aircraft. System receives fuel from a pipe line, tank truck, 55-gallon drums, or other source, stores it, filters it, and dispenses it directly to aircraft from refueling units located on a refueling apron or taxiway. Rate of refueling varies with number and type of aircraft being refueled. Maximum rate for center-point refueling is 600 gallons of jet fuel per minute for two aircraft or 300 gallons per minute for four aircraft. Overwing rate is 150 gallons per minute for each of eight hoses. System can handle jet fuel or gasoline. It contains collapsible tanks and light-weight hose for rapid installation, and can be transported in one cargo type aircraft.

2. PERSONNEL 6 Officers 6 Enlisted Men Total 6

OFFICERS							ENLISTED MEN			
Ech	No	Rank	Desig	Billet	Rate	Gp	Pay Gr	PNEC	SNEC	Title
1	1			CM2	8		5			Const Mechanic
1	1			UTC	8		7	6117		Utilitiesman
1	1			UT1	8		6		9561	Utilitiesman
1	2			UT2	8		5	6117		Utilitiesman
1	1			UT3	8		4	6117		Utilitiesman

## 3. COST

NAVAIR	_____
SPAWAR	_____
NAVFAC	\$409,631
NAVSEA	_____
NAVSUP	_____
NSF	\$ 2,994
NAVFAC	
Identified (Other)	\$142,352

## 4. CONSTRUCTION

Area required - 2.5 acres  
 Power required - 8 KVA  
 Construction time - 348 M-Hrs

## 5. MATERIEL (MAJOR ITEMS)

Ready storage, collapsible tank; pumps, valves, hose and fittings  
Filter - separators

WEIGHT: 79 short tons

CUBE: 248 measurement tons

% CONTAINERIZABLE: 80%

EST. AIRCRAFT LOADS: 3 1/4 C141 loads

### NAVAL SUPPLY SYSTEMS COMMAND

#### Sub-Function Codes

Ref	Description	WT	CU
10	Damage and safety control material	138	5
11	Administrative equipment and supplies	21	2
12	Personnel equipment and sundries	104	8
14	General equipment and supplies	1,646	47
86	Fuel for vehicles and equipment under 32 deg	10,334	267
87	Fuel for vehicles and equipment over 32 deg	10,334	267
88	POL for under 32 deg	957	25
89	POL for over 32 deg	957	25

### NAVAL FACILITIES ENGINEERING COMMAND

#### FACILITIES

FACILITY OR GROUP	ASSEMBLY OR ECC		NORTH (TEMPERATE) TOTALS
		QTY	WEIGHT LBS CUBIC FT
121 10A	Aircraft Direct Fueling Station	5	33,163.95 2,828.20
124 30E	Aircraft Ready Fuel Stor 10000 gal	8	6,876.88 346.80
125 10Z	Hoseline Pol	1	20,506.42 826.25
125 16G	Pumping Sta Pol W/one 1200 GPM Pump	1	1,300.00 350.00
143 75A	Pol Opn/Sampling/Test Facility	1	1,504.14 115.32
811 108A	Floodlight Diesel 5KW	2	7,600.00 996.00

#### TOOL KITS

80045	Kit Auto Tools Small	1	192.20 10.01
80080	Kit Repair F/Collapsible Drums	2	80.00 1.00
81007	Kit Miscellaneous Tools	1	358.52 27.53

#### INITIAL OPERATIONAL SUPPLIES

60000	Kit Test Petroleum	1	107.36 2.08
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## 1. MISSION

The Blood Bank is a facility of the M-11-E/M-2-E medical component. As a separate facility it provides blood bank capability where none exists or augments an existing blood bank. It may also be employed as a Blood Supply Unit (BSU). The blood bank has the following capabilities:

- a. Provides organic blood collection capability of 180 units of whole blood which can be subsequently converted to packed cells.
- b. Provides monitored mechanical refrigerated storage for 500 units of whole blood or packed cells.
- c. Provides a maximum capability of crossmatching two units of blood for each of 300 patients with bulk supplies (three days of operation).
- d. Provides monitored frozen (-80° Centigrade) storage for 500 units of frozen blood products (RBC, plasma, and platelets).

The M-11-E is a rapidly deployable, readily erected unit housed in a 3:1 ISO shelter; it contains three days supplies. All necessary equipment is shipped in the shelter. Eventually, the module will contain a resuscitation fluid production system which will produce all the cell wash solutions required by the blood bank.

Specialized utilities such as distilled water must be provided. All logistics support must be provided by the hospital or base to which the M-11-E is attached.

e. General Information. The blood bank receives patient blood samples for transfusion compatibility testing (crossmatching). The patient's blood sample is ordinarily tested for ABO and Rh blood types and suitable units are selected from general blood inventory and tested for compatibility with the patient's blood sample. Alternatively, units of type O blood may be administered to a patient without performing a crossmatch. After testing, the compatible units of blood are stored until picked up by (issued to) the ordering clinical service for transfusion. One large refrigerator (NSN 4110-01-117-3902) will provide refrigerated storage for 500 units of liquid blood at 1°C to 6°C. One ultra-low freezer (NSN 4110-01-234-8155) provides frozen storage for red blood cells, fresh frozen plasma, and platelets at -80°C. A 42° water bath (Blue Model 1140A) and four blood cell washers (NSN 6640-01-235-6131) are also provided for thawing and washing frozen products. Blood products will normally be supplied to the blood bank from a blood transshipment center (BTC) or a BSU (BSU may itself be a M-11-E); blood shipments are coordinated by the area joint blood program office (AJBPO). Blood may also be provided using organic resources, which provide adaptability to draw 180 units of blood, or from an accompanying M-12-E module. Note that blood cannot be collected from within the M-11-E spaces and actual bleedings will require the use of beds located elsewhere. The blood bank's capability to process blood collected with organic resources is limited to ABO, Rh, and autoagglutination control testing. Antibody screen testing is also possible

# 1. MISSION (CONTINUED)

if reagent red cells are available. The blood bank is not capable of performing NBsAg, RPR, HIV, ALT and Anti-HBc. A refrigerated centrifuge is provided to prepare packed red blood cells (PRBC) from whole blood when required. The centrifuge also provides capability for preparing platelet concentrate from freshly collected blood when this product is required. An administrative area is provided for management functions and record maintenance. A TMMIS module is also located in this area for inventory, shipping and receiving functions.

2. PERSONNEL                      1 Officers                      9 Enlisted Men      Total 10

OFFICERS							ENLISTED MEN			
Ech	No	Rank	Desig	Billet	Rate	Gp	Pay Gr	PNEC	SNEC	Title
	1	LT	2300	0866						Med Technologist
	1				HMC		7	8506		Lab Tech (Adv)
	2				HMC		6	8506		Lab Tech (Adv)
	2				HM2		5	8506		Lab Tech (Adv)
	4				HM3		4	8506		Lab Tech (Adv)

# 3. CCST

NAVFAC                      \$166,287  
Identified (Other) \$ 18,572

# 4. CONSTRUCTION

Area Required - .1 Acres  
ISO Shelters - 400 Sq. Ft.  
Shelter area - 3:1 ISO container, approximately 160 sq ft  
Power Required - 15KVA  
Overhead lighting  
110V service for laboratory equipment  
220V service for refrigerated centrifuge  
Emergency power for  
Refrigeration equipment  
Mission critical laboratory equipment  
(estimate: 7 amps per workstation)  
Water - One sink with HW, CW and drain  
HVAC - Filtered air for dual control to a level consistent with laboratory testing procedures  
Temperature control to a level consistent with reliable refrigeration equipment functioning and temperature sensitive test procedures, estimated range + 65F to + 80F  
Construction Time - 263 Man Hours

# 5. MATERIEL (MAJOR ITEMS)

## NAVAL MEDICAL COMMAND

### Sub-Function Code

Ref	Medical Assemblies	U/I	QTY	WT	CU
42	Code D-304 Laboratory Blood Bank	EA	1	26,532	2,193

## NAVAL FACILITIES ENGINEERING COMMAND

### FACILITIES

FACILITY OR GROUP	ASSEMBLY OR ECC	NORTH (TEMPERATE) TOTALS		
		QTY	WEIGHT LBS	CUBIC FT
510 10MS	Blood Bank (Expeditionary)	1	26,532.01	2,192.95
811 10TA	Electric Power Plant GED 5KW	1	610.30	21.30
811 60A	Generator Conversion Kit (Standby)	1	30.85	1.63
812 12PA	Transformer Station 15 KVA Pad Mtg	1	537.35	22.65
812 30PE	Elsc Distr Line 1000FT #6	1	268.82	10.00
812 30PR	Cable Assy (ISO) 60A and 30A	1	478.75	14.46
832 10AF	Sanitary Sewer 300 Ft 2N PVC	1	1,024.00	35.70

### CIVIL ENGINEER SUPPORT EQUIPMENT (CESE)

030731	Trk 3/4T Util	4	22,000.00	2,560.00
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## 1. MISSION

The Casualty Staging Unit serves as a temporary holding area for 25 patients awaiting evacuation/transfer to another facility either intra or inter theatre. Clinical capability is limited merely to continuing the medical treatment prescribed for the patient during movement to the next facility. It is usually located in the vicinity of or as an adjunct to a hospital. The activity to which the unit is attached must provide all required logistic support.

The Casualty Staging Unit receives patients from medical treatment facilities by means of the user service's transportation. Patients are held no longer than four hours. Medications must accompany the patient from the user treatment facility. Routine processing capability for the unit is one hundred patients per day with maximum surge capability to one hundred fifty patients per day. The unit contains five days of supplies when deployed and is both air and ground mobile.

## 2. PERSONNEL

NO	RANK/ RATE	DESIG	NORC/ NEC	TITLE
1	LT	2100	0108	Family Practitioner
1	LCDR	2900	0940	Charge Nurse
2	LCDR/LT	2900	0944	Primary Care Nurse
8	HM3/HN	HM	0000	General Service HM
7	HM1/HM3	HM	8404	Field Medical Service Technician
2	HMC	HM	8425	Advanced (IDT) Technician
1	HM2	HM	8482	Pharmacy Technician

MC=1; NC=3; HM=18

## 3. COST

NAVFAC: \$554,114  
 NAVFAC  
 Identified (Other) \$ 33,123

## 4. CONSTRUCTION

Area Required - .1 acre  
 Tents - 936 sq ft  
 Power - 28 KVA  
 Construction Time - 161 Man Hours

# 5. MATERIAL (MAJOR ITEMS)

## NAVAL FACILITIES ENGINEERING COMMAND

### FACILITIES

FACILITY OR GROUP	ASSEMBLY OR ECC		NORTH (TEMPERATE) TOTALS	
		QTY	WEIGHT LBS	CUBIC FT
510 10NJ	Casualty staging unit tent 18X52ft	3	5,290.02	421.29
811 10BN	Electric power plant diesel 2-5KW	1	2,395.20	126.11
812 302K	Distr ctr port 208/120V 30A 3PH	1	125.30	10.30

### CIVIL ENGINEER SUPPORT EQUIPMENT (CESE)

006601	Bus FC AMB conv	4	104,000.00	12,000.00
030731	Trk 3/4T util	4	22,000.00	2,560.00
036031	Trk 11/4T cargo	1	6,000.00	750.00
036131	Ambulance heavy	6	44,850.00	6,318.00

## 1. MISSION

s component consists of construction equipment and materials designed to repair bomb damage to airfield pavements. The component includes a War Damage Repair Kit for Air field Pavements, which is an ABFC Facility containing sufficient material for the repair of nine bomb craters. For the repair of more than nine craters the planner may order out additional War Damage Repair Kit Facilities for Airfield Pavement Repair. The operation planner should include on the force list, one P36 for each airfield to be repaired.

Manpower may be provided by the Naval Construction Force and/or station personnel. The operation planner may include on the force list a Naval Mobile Construction Battalion Air Detachment, Personnel Only, Unit Type Code 839DR for an Active Unit or Unit Type Code 9837D for a Reserve Unit.

## 2. PERSONNEL--NONE

## 3. COST

NAVAIR	\$ 233,300
SPAWAR	-
NAVFAC	\$6,205,692
NAVSEA	-
NAVSUP	\$ 58,000
NSF	\$ 14,000
NAVFAC	
(Identified Other)	\$ 305,548

## 4. CONSTRUCTION

Construction Time - 335 man hours

## 5. MATERIAL (Major Items)

Tractors, scoop loaders, dump trucks, road graders, rotary sweepers, pneumatic drills, paving breaker, water trucks, motorized rollers, trailer floodlights, compressor, AM2 mating, connectors, towing bars and repair tool kit.

- 36 Sets AM2 mating (5680-00-191-3665)
- 4 RRR Patch Kit (5680-00-089-5391), AM2 tools and accessories
- 14 sets portable radio equipment w/accessories
- 4 Forklift, 6000lbs.
- CBR Individual protective
- CBR Group gear

# 5. MATERIEL (MAJOR ITEMS)(CONTINUED)

## CXSE

2 jeeps, utility 4x4 - from page 1  
 9 trucks, cargo 2-1/2 T 6x6  
 9 trucks, tractor 5 T 6x6  
 18 trucks, dump 10 CY 6x4  
 1 truck, tank, fuel servicing 1200 gal.  
 2 semi trailers, stake 20T  
 2 Dolly, trailer 8T  
 4 water distributors, 2000 gal.  
 9 compressor units, rotary, 750 CFM  
 4 drills, pneumatic, crawler mtd.  
 5 graders, road DED, 6x4  
 9 loaders, scoop type, full trkd., DED 2-1/2 CY  
 2 loaders, scoop type, wheeled, 4x4 DED 5 CY  
 9 roller, motorized, compactor, vib.  
 9 tractors, full tracked  
 9 tractors wheeled 4x2  
 7 floodlight sets, trlr mtd.  
 2 welding machines, trlr mtd.  
 5 pump units, whl-mtd, 400 GPM  
 2 sweepers, magnet tractor mtd.

## Tool Kits

18 tampers, vib port rammer set, GED

## NAVAL SUPPLY SYSTEMS COMMAND

### Sub-Function Codes

Ref		WT	CU
91	materials handling equipment (provided by SPCC)		
	Gas forklift 6000 lbs (4 ea)	41,200	1832

## NAVAL FACILITIES ENGINEERING COMMAND

### FACILITIES

FACILITY ASSEMBLY OR GROUP OR ECC		NORTH (TEMPERATE)	TOTALS	
		QTY	WEIGHT LBS	CUBIC FT
111 01WD	War Damage Repair Kit for Airfields	4	117,060.00	7,075.28
111 02WD	War Damage Repair Kit For Airfields	5	.00	.00
136 00WD	War Damage Repair Kit F/Airfield	1	8,888.50	456.84

# CIVIL ENGINEER SUPPORT EQUIPMENT (CESE)

## FACILITY ASSEMBLY OR GROUP OR ECC

		QTY	NORTH (TEMPERATE) WEIGHT LBS	TOTALS CUBIC FT
030731	Trk 3/4T Util	2	11,000.00	1,280.00
064301	Trk Stake 46000GUW 6x6	6		
064512	Trk Trac 46000 GUW 6x6	9	173,340.00	13,644.00
064402	Trk Dump 6x6 46000 GUW	18	396,000.00	28,980.00
000000	Trk Tank Gen PU 6x6 46000 GUW	1		
086231	Trlr Tilt Deck	9	118,800.00	14,499.00
252105	Distrib Water 46000 GUW 6x6	5	92,500.00	8,105.00
313501	Compres 250CFM	9	37,800.00	5,427.00
442001	Grader Motor	5	153,500.00	12,720.00
453031	Loader Full-Trk	9	442,503.00	17,361.00
453152	Loader Scoop WH	2	158,420.00	7,600.00
463523	Roller Vibrate	9	197,100.00	12,330.00
485022	Tractor Crawler	9	410,400.00	14,130.00
487501	Tractor Wheeled	6	69,000.00	7,194.00
511022	Floodlight Trlr	12	45,600.00	5,976.00
522021	Pump Centrifug	9	5,373.00	270.00
571021	Magnet Road Swp	2	3,000.00	572.00

## TOOL KITS

80004	Kit Gas Cut and Weld W/Rod	1	159.53	17.24
82020	Wrench Set Imp Pneu 1/2DK Sckts	5	155.00	9.45
82050	Tamper Vib Port Rammer Set GED	18	4,203.00	343.80
85036	Rapid Runway Repair Tool Kit	1	2,100.86	198.74

Weight: 1350 Short Tons

Cube: 4450 Measurement Tons

% Containerizable: 9%

Est. Aircraft Loads: 35 C141 loads plus 9 C5 loads



## APPENDIX B. SAMPLE SURVEY PACKAGE

### GENERAL SURVEY INSTRUCTIONS

#### PRIORITIZATION OF ADVANCED BASE FUNCTIONAL COMPONENTS (ABFC)

You are the Commander of Naval Forces in a theater of operations (e.g. if OPNAV, CINCLANT, COMSERVLANT, NAVMEDCOM, etc.-- the Atlantic theater; if CINCUSNAVEUR, COMFAIRMED -- the European theater, etc.). The scenario is Base Case -- global conventional war with initial outbreak in Europe. It is now D+10, 10 days after the start of the war. You currently have the capabilities of any and all ABFCs you require to carry out your operations. You may run out of any of these. You will find descriptions of the ABFCs you are rating at enclosure (5).

The forms at enclosures (2) and (3) are two separate surveys which use different methods to elicit preferences. The specific directions for each survey are contained at the top of the survey form. **DO NOT GO BACK AND CHANGE ANY OF YOUR RESPONSES!!!** In addition, it is urged that, after you complete Survey 1, wait several hours or until the next day to complete Survey 2. They **must** be completed **independently** for the results to be useful. The questionnaire at enclosure (4) is your opportunity to express your opinions about the survey designs and to make explanatory comments about any of the responses you gave. Please include the completed questionnaire when you return the surveys.

If you have any questions or desire further information, contact LCDR Linda Guadalupe: autocon 878-2786, commercial (408) 649-8036; or Dr. Samuel Parry: autocon 878-2779, commercial (408) 646-2779.

# SURVEY 1

## EFFECT OF LOSS OF ABFC ON MISSION ACCOMPLISHMENT

You are starting with the capabilities of any and all the ABFCs you require to carry out your war plans. For each ABFC listed below, determine the level of detriment to the accomplishment of your objectives that would result if you were to be denied only that particular ABFC. Place a mark in the block under the appropriate category. DO NOT CHANGE A RESPONSE ONCE YOU HAVE DECIDED ON IT AND MADE THE MARK!!! Your first response is the one that is needed for research purposes.

<u>TITLE</u>	<u>ABFC</u> <u>CODE</u>	<u>NO</u> <u>EFFECT</u>	<u>SOME</u> <u>DETRIMENT</u>	<u>SERIOUS</u> <u>DETRIMENT</u>	<u>WAR</u> <u>STOPPING</u>
Naval Station Communication (AMCC Van)	C3A				
Cargo Handling Battalion	F1				
P-3C Intermedi- ate Support	H9L				
Link Farm (med) DFM & JP-5	D3A				
Rapi Runway Repair	P36				
Hi Speed Fuel Dispensing System	H14K				
Casualty Staging Unit	M16E				

<u>TITLE</u>	<u>ABFC</u> <u>CODE</u>	NO EFFECT	SOME DETRIMENT	SERIOUS DETRIMENT	WAR STOPPING
P-3 A/B Inter- mediate Support Activity	H9K				
Blood Bank	M11				
Aviation Tank Farm (basic)	M14E				
Naval Overseas Air Cargo Terminal (lge)	029A				

## SURVEY 2

### PAIRWISE COMPARISONS: RELATIVE EFFECT OF LOSS OF ABFC ON MISSION ACCOMPLISHMENT

You are asked to compare two ABFCs to each other, with regard to which of the two would cause more detriment to the mission if both were lost. In addition, you will give your comparison a number to designate how much more detriment the one you chose would cause. The following are descriptions of the possible "intensity values" you may choose for each pair.

INTENSITY VALUE	DEFINITION	EXPLANATION
	Equal importance	Loss of these two ABFCs would cause <u>equal</u> detriment to the mission. Both are needed equally.
3	Weak importance of one over the other	Your experience and judgment tell you that one ABFC is <u>moderately needed</u> more than the other.
5	Essential or strong importance	Experience and judgment tell you that one ABFC is <u>strongly needed</u> more than the other.
7	Very strong importance	One ABFC is <u>very strongly needed</u> more than the other; its dominance is obvious from experience.
9	Absolute importance	Your unqualified opinion is that there is the <u>highest order of need</u> for one ABFC over the other.
2, 4, 6, 8	Intermediate values between two adjacent intensities	When you must compromise

Now you are ready to complete Survey 2. Please compare each of the following pairs of ABFCs, a pair at a time, independently of any of the other pairs. Choose the letter, X or Y, which corresponds to the ABFC in that pair which would cause the most detriment to the accomplishment of your objectives if both were denied you. Then select one of the "intensity values" described above to show the extent of the comparison. (If you feel that both would cause equal detriment to the mission, write both the letters: "X and Y", and place a "1" in the column marked Intensity Value.) You are reminded: DO NOT CHANGE A RESPONSE ONCE YOU HAVE MARKED IT DOWN!!!

X	Y	If both X and Y were lost, more detriment would be caused by the loss of:	Intensity value
AMCC VAN	P3-C INT. SUPPORT ACT.		
CARGO HAND- LING BATT.	AVIATION TANK FARM		
P3-A/B INT. SUPPORT ACT.	BLOOD BANK		
CASUALTY STAGING UNIT	P3-C INT. SUPPORT ACT.		
RAPID RUNWAY REPAIR	TANK FARM		
BLOOD BANK	RAPID RUNWAY REPAIR		
TANK FARM	CARGO HANDLING BATT.		

X	Y	More detriment would be caused by the loss of:	Intensity value
<hr/>			
P3-A/B INT. SUPPORT ACT.	CASUALTY STAGING UNIT		
TANK FARM	P3-A/B INT. SUPPORT ACT.		
P3-A/B INT.	CARGO HANDLING		
BLOOD BANK	AMCC VAN		
RAPID RUNWAY REPAIR	AVIATION TANK FARM		
CARGO HAND- LING BATT.	P3-C INT. SUPPORT ACT.		
P3-A/B INT. SUPPORT ACT.	AMCC VAN		
AMCC VAN	CARGO HANDLING BATT.		
NOAC	RAPID RUNWAY REPAIR		
TANK FARM	CASUALTY STAGING UNIT		
HI SPEED FUEL DISP. SYSTEM	AVIATION TANK FARM		
CARGO HAND- LING BATT.	NOAC		
AMCC VAN	CASUALTY STAGING UNIT		
AVIATION TANK FARM	BLOOD BANK		
P3-C INT. SUPPORT ACT.	AVIATION TANK FARM		
RAPID RUNWAY REPAIR	HI SPEED FUEL DISP. SYSTEM		

X	Y	More detriment would be caused by the loss of:	Intensity value
BLOOD BANK	NOAC		
P3-C INT. SUPPORT ACT.	HI SPEED FUEL DISP. SYSTEM		
CASUALTY STAGING UNIT	BLOOD BANK		
AMCC VAN	HI SPEED FUEL DISP. SYSTEM		
CASUALTY STAGING UNIT	RAPID RUNWAY REPAIR		
RAPID RUNWAY REPAIR	AMCC VAN		
P3-A/B INT. SUPPORT ACT.	NOAC		
RAPID RUNWAY	P3-C INT. T.		
HI SPEED FUEL DISP. SYSTEM	CARGO HANDLING BATT.		
BLOOD BANK	P3-C INT. SUPPORT ACT.		
NOAC	P3-C INT. SUPPORT ACT.		
P3-A/B INT. SUPPORT ACT.	RAPID RUNWAY REPAIR		
NOAC	AVIATION TANK FARM		
P-3C INT. SUPPORT ACT.	TANK FARM		
AMCC VAN	NOAC		
P3-A/B INT. SUPPORT ACT.	P3-C INT. SUPPORT ACT.		
HI SPEED FUEL DISP. SYSTEM	P3-A/B INT SUPPORT ACT.		

X	Y	More detriment would be caused by the loss of:	Intensity value
CASUALTY STAGING UNIT	CARGO HANDLING BATT.		
AMCC VAN	TANK FARM		
TANK FARM	NOAC		
NOAC	CASUALTY STAGING UNIT		
HI SPEED FUEL DISP. SYSTEM	NOAC		
CARGO HAND- LING BATT.	BLOOD BANK		
AVIATION TANK FARM	AMCC VAN		
HI SPEED FUEL DISP. SYSTEM	TANK FARM		
CASUALTY STAGING UNIT	HI SPEED FUEL DISP. SYSTEM		
AVIATION TANK FARM	P3-A/B INT. SUPPORT ACT.		
BLOOD BANK	HI SPEED FUEL DISP. SYSTEM		
TANK FARM	AVIATION TANK FARM		
RAPID RUNWAY REPAIR	CARGO HANDLING BATT.		
AVIATION TANK FARM	CASUALTY STAGING UNIT		
BLOOD BANK	TANK FARM		



### RATER QUESTIONNAIRE

1. DID YOU HAVE ANY DIFFICULTY UNDERSTANDING THE SCENARIO PRESENTED? \_\_\_\_\_ IF SO, PLEASE COMMENT: \_\_\_\_\_

WOULD YOU HAVE PREFERRED THAT THE SITUATION BE DESCRIBED DIFFERENTLY? \_\_\_\_\_ IF SO, HOW? \_\_\_\_\_

2. DID YOU HAVE ANY DIFFICULTY UNDERSTANDING THE INSTRUCTIONS FOR GIVING RESPONSES? \_\_\_\_\_ IF SO, EXPLAIN: \_\_\_\_\_

3. THE TWO SURVEYS ARE VERY DIFFERENT WITH REGARD TO DESIGN. DID YOU FEEL MORE COMFORTABLE RESPONDING TO ONE THAN THE OTHER? \_\_\_\_\_ IF SO, WHICH ONE AND WHY? \_\_\_\_\_

DID ONE METHOD SEEM MORE REALISTIC FOR RATING THE VALUE OF ABFCs? \_\_\_\_\_ IF YES, WHICH ONE AND WHY? \_\_\_\_\_

4. USE THIS SPACE AND THE OTHER SIDE OF THIS SHEET FOR OTHER COMMENTS, INCLUDING THOSE YOU WISH TO MAKE REGARDING ANY OF YOUR SURVEY RESPONSES:

# APPENDIX C. PROGRAMS DEVELOPED FOR THESIS

## NORMALIZATION OF CUMULATIVE FREQUENCIES [REF. 6: PP.87-88]

```

V NORM:MTX:NOR:ROWAV:GRAV:S:AA:E:AAI:II
[1]  D+'INPUT THE CUMULATIVE FREQUENCIES'
[2]  D+'INSURE THAT THERE ARE NO VALUES OF'
[3]  D+'ZERO (0) OR OF ONE (1)'
[4]  MTX=D
[5]  NOR=NQUAN MTX
[6]  S=D*MTX
[7]  ROWAV=(+/NOR)+(S[2])
[8]  ROWAV=(S[1],1)*ROWAV
[9]  COLAV=(+/NOR)+(S[1])
[10] GRAV=(+/(+/NOR))/((S[1])*(S[2]))
[11] D+'NORMALIZED VALUES          ROW AVERAGE'
[12] D+'-----'
[13] D+NOR,ROWAV
-14-  --' COLUMN AVERAGES '
-15-  --'-----'
-16-  --COLAV
-17-  --'GRAND AVERAGE'
-18-  --'-----'
-19-  --GRAV
-20-  AAI=S-0
-21-  II=0
-22-  L2:II=II+1
-23-  AA=(NOR-(II)--,ROWAV)*2
-24-  AAI=II-AA
-25-  -(II<S-2-)/L2
-26-  AAI=(S)-AAI
-27-  AAI=+/AAI
-28-  B=+/(COLAV-GRAV)*2
-29-  SQR=(E-AAI)*0.5
-30-  SQR=((S-1-),1)-SQR
-31-  SSI=GRAV-(ROWAV-SQR)
-32-  AAI=(S-1-,1)-AAI
-33-  GRAV=(S-1-,1)-GRAV
-34-  --' B '
-35-  --'-----'
-36-  --B
-37-  --' AI '
-38-  --'-----'
-39-  --AAI
-40-  --'SCALE VALUES = GRAND AVERAGE - (ROW AVERAGE-(B-AI)*.5)'
-41-  --'-----'
-42-  --SSI,GRAV,ROWAV,SQR
-43-  --' COLUMN AVERAGES '
-44-  --'-----'
-45-  --COLAV

```

# NORMAL TABLE LOOK-UP (DEVELOPED AT NPS) [REF. 6: PP. 87-88]

```

V Z+NQUAN P;A;B;C;D
[1]  +((+/(A+(P<0.5))v(F<1)))>0)/L1
[2]  C+ 2.515517 0.802853 0.010328
[3]  D+ 1.432788 0.183269 0.001308
[4]  F+((A+(P<0.5))*P)+((P>0.5)*(1-F))
[5]  B+(CP*2)*0.5
[6]  Z+((2*Z)-1)*B-((B*. 0 1 2)+.*C)+(1+((B*. 1 2 3)+.*D))
[7]  +0
[8]  L1:Q+'THERE IS NO QUANTILE FOR P = ',B/A/P
V

```

## DETERMINATION OF CUMULATIVE FREQUENCIES [REF. 6: PP. 87-88]

```

V JUDGES;D;N;SHAPE;FREQ;CONFREQ
[1]  Q+'INPUT THE RAW DATA POINTS '
[2]  Q+'THE NUMBER OF OBSERVATIONS'
[3]  Q+'IN EACH ROW MUST BE THE SAME'
[4]  D+Q
[5]  N++/D
[6]  SHAPE+QD
[7]  N+N[1]
[8]  FREQ+D[1:(SHAPE[2])]N
[9]  Q+'RELATIVE FREQUENCY'
[10] Q+'-----'
[11] Q+FREQ
[12] Q+' '
[13] CONFREQ++\FREQ
[14] Q+'CUMULATIVE FREQUENCY'
[15] Q+'-----'
[16] Q+CONFREQ
V

```

# SCALE VALUE COMPUTATIONS FROM PAIRWISE COMPARISONS

```

* DECLARE VARIABLES
  INTEGER P, Q, R
  PARAMETER (P=11,Q=46,R=23)
  INTEGER I, J, L, ARRAY(Q), C1, C2, T
  REAL FIRST, SECOND, THIRD, FOURTH, RAW(P,P,2,R), RAW2(P,P,2,R),
  1A(P,P,R), AP(P,P,R), AB(P,P), ABP(P,P), NORM(P,P), W(P,P), S(P), SP(P)
  CHARACTER*16 ABFC(P)
  DATA RAW,RAW2/5566*0,5566*0/,FIRST,SECOND,THIRD,FOURTH/0,0,0,0/
  CALL EXCMS ('FILEDEF 01 DISK NAMEABFC DATA A1 (LRECL 80)')
  CALL EXCMS ('FILEDEF 02 DISK ABFC DATA A1 (LRECL 128)')
  CALL EXCMS ('FILEDEF 03 DISK ABFCREP LISTING A1 (LRECL 80)')

*
* READ NAMES INTO ABFC ARRAY
  DO 3 I=1,P
    READ (01,4) ABFC(I)
    FORMAT (A16)
  3 CONTINUE
*
* READ DATA INTO BOTH RAW ARRAYS
100 READ (02,10,END=200) C1,C2,ARRAY
10  FORMAT (2(I3),46(I2))
*
* TRANSFORM TO 100 POINT SCALE TO CREATE ARRAY RAW1 FOR CONSTANT SUM
* METHOD AND ADD RECIPROCALLS TO CREATE ARRAY RAW2 FOR AHP METHOD
  T=0
  DO 15 I = 1,Q,2
    T=T+1
    IF (ARRAY(I) .GT. 9) THEN
      PRINT *, I, 'ERROR9'
    ELSE IF (ARRAY(I+1) .GT.9) THEN
      PRINT *, I+1, 'ERROR9'
    ELSE IF (ARRAY(I) .GT. 0) THEN
      FIRST=(ARRAY(I)*100)/(ARRAY(I)+1)
      SECOND=100-FIRST
      THIRD= ARRAY(I)
      FOURTH=1.0/(ARRAY(I))
    ELSE IF (ARRAY(I+1) .GT. 0) THEN
      SECOND=(ARRAY(I+1)*100)/(ARRAY(I+1)+1)
      FIRST=100-SECOND
      FOURTH=APLAY(I+1)
      THIRD=1.0/(ARRAY(I+1))
    ELSE
      PRINT *, I,I+1, 'ERROR8'
    ENDIF
* PLACE VALUES FOR COMPARISONS OF PAIRS NOT COMPARED IN OPPOSITE ORDER
* (THAT IS, PLACE THE CROSS-DIAGONAL VALUES INTO THE MATRIX)
    IF (C1 .GT. C2) THEN
      RAW(C2,C1,2,T)=FIRST
      RAW(C2,C1,1,T)=SECOND
      RAW2(C2,C1,2,T)=THIRD
      RAW2(C2,C1,1,T)=FOURTH
    ELSE IF (C2 .GT. C1) THEN
      RAW(C1,C2,1,T)=FIRST
      RAW(C1,C2,2,T)=SECOND
      RAW2(C1,C2,1,T)=THIRD
      RAW2(C1,C2,2,T)=FOURTH
    ENDIF
    FIRST=0
    SECOND=0
    THIRD=0
    FOURTH=0
15  CONTINUE
  GOTO 100

```

```

200 DO 35 L=1,R
      DO 40 I=1,P
        A(I,I,L)=50
        AP(I,I,L)=1
        IF (I.EQ.P) THEN
          GO TO 40
        ELSE
          DO 45 J=I+1,P
            A(I,J,L)=RAW(I,J,2,L)
            A(J,I,L)=RAW(I,J,1,L)
            AP(I,J,L)=RAW2(I,J,1,L)
            AP(J,I,L)=RAW2(I,J,2,L)
45      CONTINUE
          ENDIF
60      CONTINUE
35    CONTINUE
*
* AGGREGATE THE TWO FORMS OF MATRICES OVER ALL JUDGES, USING ARITHMETIC
* MEAN FOR CONSTANT SUM METHOD (ONE AB MATRIX) AND GEOMETRIC MEAN FOR
* AHP METHOD (ONE AB-PRIME MATRIX)
      DO 50 I=1,P
        DO 55 J=1,P
          AB(I,J)=0
          ABP(I,J)=1
          DO 60 L=1,R
            AB(I,J)=AB(I,J)+A(I,J,L)
            ABP(I,J)=ABP(I,J)*AP(I,J,L)
60      CONTINUE
          AB(I,J)=(AB(I,J)/R)
          ABP(I,J)=(ABP(I,J))**(1.0/R)
55    CONTINUE
50  CONTINUE
*
* COMPUTE THE W MATRIX FOR CONSTANT SUM METHOD
      DO 65 I=1,P
        DO 70 J=1,P
          W(I,J)=AB(I,J)/AB(J,I)
70      CONTINUE
65  CONTINUE
*
* NORMALIZE THE AB-PRIME MATRIX FOR THE AHP METHOD
      DO 75 J=1,P
        DENOM = 0
        DO 80 I=1,P
          DENOM = DENOM + ABP(I,J)
80      CONTINUE
        DO 85 I=1,P
          NORM(I,J)=ABP(I,J)/DENOM
85      CONTINUE
75  CONTINUE
*
* COMPUTE THE SCALE VALUES FOR THE CONSTANT SUM METHOD, S(J)
      DO 90 J=1,P
        S(J)=1
        DO 95 I=1,P
          S(J)=S(J)*W(I,J)
95      CONTINUE
90  CONTINUE
      DO 105 I=1,P
        S(I)=S(1)**(1.0/P)
105 CONTINUE

```

```

*
* COMPUTE THE SCALE VALUES FOR THE AHP METHOD, SP(I)
DO 110 I=1,P
  SP(I)=0
  DO 115 J=1,P
    SP(I)=NORM(I,J)+SP(I)
115  CONTINUE
    SP(I)=(SP(I))/P
110  CONTINUE
*
* WRITE CONSTANT SUM METHOD ARRAYS TO FILE
WRITE(3,*)
WRITE(3,*) 'A MATRICES'
DO 120 L=1,R
  DO 125 I=1,P
    WRITE(3,140) (A(I,J,L),J=1,P)
125  CONTINUE
  WRITE(3,*)
120  CONTINUE
  WRITE(3,*) 'AB MATRIX'
  DO 130 I=1,P
    WRITE(3,140) (AB(I,J), J=1,P)
130  CONTINUE
  WRITE(3,*)
  WRITE(3,*) 'W MATRIX'
  DO 135 I=1,P
    WRITE(3,140) (W(I,J), J=1,P)
135  CONTINUE
140  FORMAT (11(F6.2))
*
* WRITE THE AHP METHOD ARRAYS TO FILE
WRITE(3,300)
300  FORMAT (/80('-')/)
WRITE(3,*) 'A-PRIME MATRICES'
DO 145 L=1,R
  DO 150 I=1,P
    WRITE(3,140) (AP(I,J,L),J=1,P)
150  CONTINUE
  WRITE(3,*)
145  CONTINUE
  WRITE(3,*) 'AGGREGATED AB-PRIME MATRIX'
  DO 155 I=1,P
    WRITE(3,140) (ABP(I,J), J=1,P)
155  CONTINUE
  WRITE(3,*)
  WRITE(3,*) 'NORMALIZED AGGREGATED AB-PRIME MATRIX'
  DO 160 I=1,P
    WRITE(3,140) (NORM(I,J), J=1,P)
160  CONTINUE
  WRITE(3,*)
  WRITE(3,300)
  WRITE(3,*) 'ABFC NO.          NAME          S (CONSUM)      S (AHP)'
  DO 165 I=1,P
    WRITE(3,400) I,ABFC(I),S(I),SP(I)
400  FORMAT (/3X,I2.6X,A16.3X,F7.3,8X,F8.4)
165  CONTINUE
STOP
END

```

# APPENDIX D. STEP-BY-STEP APPLICATIONS

## Constructing Interval Scales From Categorical Judgments

Step 1 RAW DATA:

ABFC #	ABFC NAME	NO	LEVEL OF DETRIMENT		
			SOME	SERIOUS	WARSTOPPING
1	AMCC Vari	1	10	10	2
2	Cargo Handling Bat.	0	7	11	5
3	P-3C Int. Supp. Fac.	5	7	10	1
4	Tank Farm (med.)	2	9	12	0
5	Rapid Runway Repair	0	5	10	8
6	Hi Speed Fuel Disp.	3	13	6	1
7	Casualty Staging Unit	5	13	5	0
8	P-3A/B Int. Sup. Fac.	5	10	8	0
9	Blood Bank	6	12	5	0
10	Aviation Tank Farm	2	8	11	2
11	Nav O'seas Air Cargo	2	7	14	0

Step 2 GROUPING MATRICES: The matrices were grouped based on removal of columns with values <0.02 and >0.98.

GRPAB				
4		0.08695652174	0.4782608696	
7		0.2173913043	0.7826086957	
8		0.2173913043	0.652173913	
9		0.2608695652	0.7826086957	
11		0.08695652174	0.3913043478	
GRPABC				
1		0.04347826087	0.4782608696	0.9130434783
3		0.2173913043	0.5217391304	0.9565217391
6		0.1304347826	0.6956521739	0.9565217391
10		0.08695652174	0.4347826087	0.9130434783
GRFBC				
2		0.3043478261	0.7826086957	
5		0.2173913043	0.652173913	

The remainder of the steps was performed for each group.  
GROUP AB:

### NORMALIZED VALUES

-1.359962536	-0.05437545303
-0.7808184192	0.7808184192
-0.7808184192	0.3907534547
-0.6403412743	-0.7808184192
-1.359962536	-0.2754955949

### ROW AVERAGES

-0.7071689945
0
-0.1950324823
-0.07023857243
-0.8177290655

### GRAND AVERAGE

-0.329938394
--------------

# SCALE VALUES OF INSTANCES

```

-----
-0.3790166332
-0.329938394
-0.1120473742
-0.3946279417
0.6570099831
  
```

## COLUMN AVERAGES

```

-----
-0.984380637 0.324503849
  
```

## GROUP ABC:

### NORMALIZED VALUES

```

-----
-1.712054734 -0.05437545303 1.359962536
-0.7808184192 0.05437545303 1.712054734
-1.124405025 -0.51153131 1.712054734
-1.359962536 -0.1638765529 1.359962536
  
```

### ROW AVERAGES

```

-----
-0.135489217
0.328537256
-0.3663936731
-0.05462551764
  
```

### GRAND AVERAGE

```

-----
0.1262040486
  
```

# SCALE VALUES OF INSTANCES

```

-----
-0.2487367588
-0.2338513763
-0.2316426674
0.181924521
  
```

## COLUMN AVERAGES

```

-----
-1.244310179 0.08691368928 1.536008635
  
```

## GROUP BC:

### NORMALIZED VALUES

```

-----
-0.51153131 0.7808184192
-0.7808184192 0.3907534547
  
```

### ROW AVERAGES

```

-----
-0.1346435546
-0.1950324823
  
```

### GRAND AVERAGE

```

-----
-0.03019446384
  
```

# SCALE VALUES OF INSTANCES

```

-----
-0.1525463934
0.1748910102
  
```

## COLUMN AVERAGES

```

-----
-0.6461748646 0.5857859369
  
```



SCALE EQUALIZATION: By transforming the scales for groups A1 and BC so that the upper bounds of their categories were the same as those for Group ABC, the following final scale values for each ABFC were obtained:

Rapid Runway Repair	1.0527
Cargo Handling Battalion	0.6605
Naval Overseas Air Cargo Terminal	0.4251
Naval Station Communication (AMCC Van)	0.2487
Aviation Tank Farm	0.1819
Tank Farm (medium, DFM & JP-5)	0.1424
High Speed Fuel Dispensing System	-0.2316
P-3C Intermediate Support Facility	-0.2339
P-3A/B Intermediate Support Facility	-0.3571
Casualty Staging Unit	-0.5787
Blood Bank	-0.6445

# The Constant Sum Method

RAW DATA: (Judge #1)		ABFC #										
		1	2	3	4	5	6	7	8	9	10	11
	1		9	1	3	5	1	3		9	1	3
	2											
	3											
A	4	1	9		3	5	1	5	1	7	3	3
B	5		9			5	1	5		5		
F	6		7					3		3		
C	7	1	9	1	1	5		3	1	7	3	1
	8		9					1		3		
#	9	3	9	1	3	3	1	3		7	3	3
	10		7									
	11	1	9		5	5		5		7		3
			9		3	5	1	3		7		

## A MATRIX (Judge #1):

50.00	90.00	50.00	75.00	83.00	50.00	75.00	25.00	83.00	50.00	75.00
10.00	50.00	10.00	10.00	13.00	10.00	10.00	10.00	13.00	10.00	10.00
50.00	90.00	50.00	75.00	83.00	50.00	83.00	50.00	87.00	75.00	75.00
25.00	90.00	25.00	50.00	83.00	50.00	83.00	25.00	83.00	17.00	25.00
17.00	87.00	17.00	17.00	50.00	17.00	75.00	25.00	75.00	17.00	17.00
50.00	90.00	50.00	50.00	83.00	50.00	75.00	50.00	87.00	75.00	50.00
25.00	90.00	17.00	17.00	25.00	50.00	50.00	25.00	75.00	17.00	25.00
75.00	90.00	50.00	75.00	75.00	50.00	75.00	50.00	87.00	75.00	75.00
17.00	87.00	13.00	17.00	25.00	13.00	25.00	13.00	50.00	13.00	13.00
50.00	90.00	25.00	83.00	83.00	25.00	83.00	25.00	87.00	50.00	75.00
25.00	90.00	25.00	75.00	83.00	50.00	75.00	25.00	87.00	25.00	50.00

## AB MATRIX:

50.00	56.00	40.91	42.52	60.13	41.61	35.78	40.74	36.26	43.65	42.26
43.91	50.00	47.00	30.87	62.09	31.09	21.43	40.04	23.70	39.35	33.17
59.09	53.00	50.00	54.04	62.91	39.09	30.83	38.65	33.00	50.78	42.30
57.48	69.13	45.96	50.00	68.30	44.26	37.04	40.04	37.57	50.74	47.26
39.87	37.91	37.09	31.70	50.00	27.13	24.61	36.70	27.35	33.96	37.17
58.30	68.91	60.91	55.74	72.87	50.00	38.30	50.48	35.30	60.13	55.35
64.22	78.57	69.17	62.96	75.39	61.70	50.00	63.09	47.26	68.30	64.04
59.26	59.96	61.35	59.96	63.30	69.52	36.91	50.00	37.57	59.30	47.30
63.74	76.30	67.00	62.43	72.65	64.70	52.74	62.43	50.00	70.87	64.26
50.55	60.65	49.22	49.26	66.04	39.87	31.70	40.70	29.13	50.00	49.57
57.74	66.83	57.70	52.74	62.83	44.65	35.96	52.70	35.74	50.43	50.00

## W MATRIX:

1.00	1.28	0.69	0.74	1.51	0.71	0.56	0.69	0.57	0.77	0.73
0.78	1.00	0.89	0.45	1.64	0.45	0.27	0.67	0.31	0.65	0.49
1.44	1.13	1.00	1.18	1.70	0.64	0.45	0.63	0.49	1.03	0.73
1.35	2.24	0.85	1.00	2.16	0.79	0.59	0.67	0.60	1.03	0.90
0.66	0.61	0.59	0.46	1.00	0.37	0.33	0.58	0.38	0.51	0.59
1.40	2.22	1.56	1.26	2.69	1.00	0.62	1.02	0.55	1.51	1.24
1.79	3.67	2.24	1.70	3.06	1.61	1.00	1.71	0.90	2.16	1.78
1.45	1.50	1.59	1.50	1.73	0.98	0.59	1.00	0.60	1.46	0.90
1.76	3.22	2.03	1.66	2.66	1.83	1.12	1.66	1.00	2.43	1.80
1.29	1.54	0.97	0.97	1.94	0.66	0.46	0.69	0.41	1.00	0.98
1.37	2.01	1.36	1.12	1.69	0.81	0.56	1.11	0.56	1.02	1.00

SCALE VALUES:

Rapid Runway Repair	1.893
Cargo Handling Battalion	1.646
Naval Station Communication (AMCC Van)	1.249
P-3C Intermediate Support Facility	1.148
Aviation Tank Farm	1.112
Tank Farm (medium, DFM & JP-5)	1.004
Naval Overseas Air Cargo Terminal	0.938
P-3A/B Intermediate Support Facility	0.881
High Speed Fuel Dispensing System	0.807
Casualty Staging Unit	0.549
Blood Bank	0.548

# The Analytical Hierarchy Process

RAW DATA: Same as for the Constant Sum Method

## A-PRIME MATRIX: (judge #1)

1.00	0.11	1.00	0.33	0.20	1.00	0.33	3.00	0.20	1.00	0.33
9.00	1.00	9.00	9.00	7.00	9.00	9.00	9.00	7.00	9.00	9.00
1.00	0.11	1.00	0.33	0.20	1.00	0.20	1.00	0.14	0.33	0.33
3.00	0.11	3.00	1.00	0.20	1.00	0.20	3.00	0.20	5.00	3.00
5.00	0.14	5.00	5.00	1.00	5.00	0.33	3.00	0.33	5.00	5.00
1.00	0.11	1.00	1.00	0.20	1.00	0.33	1.00	0.14	0.33	1.00
3.00	0.11	5.00	5.00	3.00	3.00	1.00	3.00	0.33	5.00	3.00
0.33	0.11	1.00	0.33	0.33	1.00	0.33	1.00	0.14	0.33	0.33
5.00	0.14	7.00	5.00	3.00	7.00	3.00	7.00	1.00	7.00	7.00
1.00	0.11	3.00	0.20	0.20	3.00	0.20	3.00	0.14	3.00	0.33
3.00	0.11	3.00	0.33	0.20	1.00	0.33	3.00	0.14	3.00	1.00

## AGGREGATION -- AB-PRIME MATRIX:

1.00	0.76	1.54	1.48	0.62	1.53	2.08	1.61	2.01	1.42	1.51
1.32	1.00	1.19	2.65	0.56	2.56	4.13	1.62	3.62	1.74	2.26
0.65	0.84	1.00	0.83	0.52	1.68	2.57	1.71	2.34	0.98	1.44
0.68	0.38	1.21	1.00	0.38	1.34	1.86	1.57	1.84	0.98	1.11
1.62	1.80	1.93	2.64	1.00	3.10	3.50	1.95	3.23	2.21	1.92
0.68	0.39	0.60	0.75	0.32	1.00	1.75	0.94	1.93	0.60	0.80
0.48	0.74	0.39	0.54	0.29	0.57	1.00	0.54	1.15	0.41	0.50
0.62	0.62	0.59	0.64	0.51	1.06	1.85	1.00	1.85	0.67	1.15
0.50	0.28	0.43	0.54	0.31	0.52	0.89	0.55	1.00	0.37	0.50
0.71	0.57	1.02	1.02	0.45	1.66	2.41	1.50	2.73	1.00	1.01
0.66	0.44	0.70	0.90	0.52	1.24	2.01	0.87	2.02	0.99	1.00

## NORMALIZED AB-PRIME MATRIX:

0.11	0.10	0.15	0.11	0.11	0.09	0.09	0.12	0.08	0.12	0.11
0.15	0.14	0.11	0.20	0.10	0.16	0.12	0.12	0.15	0.15	0.17
0.07	0.11	0.09	0.06	0.09	0.10	0.11	0.12	0.10	0.09	0.11
0.08	0.05	0.11	0.03	0.07	0.08	0.08	0.11	0.08	0.09	0.08
0.18	0.25	0.18	0.20	0.18	0.19	0.15	0.14	0.14	0.19	0.15
0.07	0.05	0.08	0.06	0.06	0.06	0.07	0.07	0.08	0.05	0.06
0.05	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.04	0.04
0.07	0.08	0.06	0.05	0.09	0.07	0.08	0.07	0.08	0.06	0.09
0.06	0.04	0.04	0.04	0.06	0.03	0.04	0.04	0.04	0.03	0.04
0.08	0.08	0.10	0.03	0.03	0.10	0.10	0.11	0.12	0.09	0.07
0.07	0.06	0.07	0.07	0.10	0.08	0.08	0.06	0.09	0.09	0.08

#### SCALE VALUES:

Rapid Runway Repair	0.1772
Cargo Handling Battalion	0.1478
Naval Station Communication (AMCC Van)	0.1100
P-3C Intermediate Support Facility	0.0971
Aviation Tank Farm	0.0914
Tank Farm (medium, DFM & JP-5)	0.0827
Naval Overseas Air Cargo Terminal	0.0760
P-3A/B Intermediate Support Facility	0.0719
High Speed Fuel Dispensing System	0.0634
Casualty Staging Unit	0.0414
Blood Bank	0.0412

The Analytical Hierarchy Process described an additional measurement not included in the Constant Sum Method. When making pairwise comparisons, the possibility exists for a judge to rate item A over item B and rate item B over item C, but then to rate item C over item A, which is an inconsistent comparison. The consistency ratio in the Analytical Hierarchy Process measures the extent to which judges contradicted themselves in this way. Consistency ratio values of 0.1 or less are considered to be acceptable. The judges ratings from Survey 2 were computed to have a consistency ratio of 0.05849, a highly consistent result.

## APPENDIX E. JUDGES' COMMENTS FROM SURVEYS

**Answers to the Question: Did you have any difficulty understanding the scenario presented? If so, please comment:**

Does not specify whether Host Nation Support arrangements, in place or being negotiated, are to be considered. Also not clear whether "theater specific" response was desired...

Not enough detail as to our concept of ops, enemy actions, attrition, Host Nation Support, etc., etc., etc.

**Answers to the Question: Would you have preferred that the situation be described differently? If so, how?**

Since most of my experience relates to Europe, it was difficult to try to restrict choices...

Specify "come as you are" or "assume you have everything you need to complement Host Nation Support."

A more detailed scenario would have restricted the amount of imagination required.

Requirements for the ABFCs should have been identified/related to a specific OPLAN.

**Answers to the Question: Did you have any difficulty understanding the instructions for giving responses? If so, explain:**

The instructions were clear but I have a very sketchy knowledge of the ABFC requirements for its CINC plans. This made all choices suspect.

**Answers to the Question: Did you feel more comfortable responding to one (survey) than the other? If so, which one and why?**

I felt more comfortable with the first.

First one -- not comparing apples and oranges per se.

Survey #1 is easier to follow.

Second survey was very long.

Survey 1 -- more realistic.

Survey 1 is easier. Survey 2 seemed to run together after one page. I felt like I had compared some of the choices before.

The second one is very dependent on theater, threat and operations at the time of the event. The priorities on an ABFC will change dependent on scenario.

More comfortable with Survey #2 -- not as scenario dependent.

Survey #1 was easier to follow.

Survey 1. Choices were clear cut, without the requirement to balance impact of loss of one ABFC over another.

It was easier to respond to the first due to the fact that it is more valid to respond to an ABFC's value to an operation vice its relative merits within an operation.

Survey 1 was easier. You didn't have to "quantify" your guesses.

**Answers to the Question: Did one method seem more realistic for rating the value of ABFCs? If yes, which one and why?**

Survey 1. Asks "real life" questions.

First method since (it was) more general. Comparing one against the other can go either way depending on specific geographic location.

As with anything, value is relative. We are trying to hedge our bets by determining which ABFCs are more important. The answer is always going to be a moving target.

The first, it seemed to allow a broader general perception of the importance of a given ABFC without a strict comparison.

The second -- the comparative values -- one against the other -- causes more thought of each one's relative worth.

(Survey 1) is more realistic -- comparing non-like items (as in Survey 2) is unrealistic in some cases.

Comparison: provides for greater subjectivity and causes rater to provide a respective value of his selection.

Survey #1. Compared each item to itself rather than to other items which in many cases were not related.

To try to rate one ABFC versus another is difficult due to different functions they perform. Contribution to war effort (prioritize which I need most) would be better method, i.e., #1, #2, etc.

Scenario is too general for a realistic rating of Survey 2.

Survey 2 is better. I had to compare each choice and the effects it would have at that time of war.

2nd -- comparison values vice absolute.

Survey 1, if one takes the results of this survey for POMing (Program Objectives Memorandum: a process in the Federal budget) ABFCs, it could be a serious mistake. The 4040 report that the CINCs (Commanders-in-Chief) submit plus SITREPs (Situation Reports) should be used.

Survey 2. In a global war scenario, preceded by an extended period of resource austerity, more than one ABFC may not be available or up to strength, which would necessitate some hard choices.

#### **Miscellaneous Comments:**

Assume survey intended to be subjective. Only objective method to determine relative importance is to have all existing in-theater resources related to theater requirements, enumerate the deficiencies and prioritize them as to mission degradation, then match ABFCs against the deficiency list. This is what fleets are supposed to do when submitting ABFC priorities to OPNAV (Office of the Chief of Naval Operations).

I found Survey 1 easier, but I do not know that it is more realistic.

...These questionnaires require a fairly detailed knowledge of the CINC OPLANS (Commander-in-Chief Operations Plans) and the resources available for carrying them out. The answers given are a 'guess', at best. These are not good surveys unless the person filling them out has the necessary background. For example, the number of P-3 A/B aircraft in the OPLAN and the current facilities available; the fueling capability of anticipated air facilities; etc.

I have evaluated the ABFCs from the perspective of (one particular Commander-in-Chief, who has particular area responsibilities). I have assumed Host Nation Support to be as currently available, with a sufficient number of ABFCs to compensate for deficiencies in Host Nation Support. For example, (in some areas),... fuel ABFCs would not be needed; thus, their low priority. Also, (one particular ABFC) is important to me because that is my key function. (A particular Commander-in-Chief) might rate it lower than I and put something else higher. Life-support ABFCs always rate highest priority in my opinion.

Most of the ABFCs are important but I have serious reservations they would be functional on D+10. The AFOE would still be off-loading and in a global war, the fighting would still be hot and heavy.

...I worry that this survey could be used for POM issues. As stated, the CNO should use the 4040 report and the CINC's SITREPS.



...Survey #2 ends up comparing ABFCs when the scenario is not given in detail. It is hard to say medical is less important than P-3C maintenance when taking care of our men is so important. However, if we don't have the support for our forces, the casualties are going to be even higher. The point is that the priority of any ABFC can and does change because of factors such as:

- 1) Theater of operations
- 2) Available inter-service support
- 3) War time Host Nation Support
- 4) Threat
- 5) Concept of Ops, which can change dependent on timing, threat, mission, etc.
- 6) Forces to be supported changes

Logistics is not as easy as making a formula and letting a computer do the work. One must look at the "big picture" to see what is required for that mission, area, and forces. Each location is different, each scenario is different.

I'm not sure the results of this survey will provide a valid indication of relative merits of ABFCs. ...I think you need to focus on a small set of related ABFCs; example: P-3 support; and do some in-depth ops analysis of their capabilities in a 6-month "campaign," similar to (another project being worked). I don't think it is possible to rank ABFCs without this type of analysis.

My response may have been different if I knew the (specific) scenario in which these ABFCs were being utilized.

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